FIELD EVALUATIONS AND DEFINITION OF THE PROPOSED AIR FORCE FORWARD BASE FOODSERVICE SYSTEM- THE NEW HARVEST EAGLE

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This report presents the findings and conclusions of field tests of a new Air Force forward base foodservice system, the New Harvest Eagle, including a feasibility test at Eglin Air Force Base, FL, and a field operational test at Team Spirit '81 at the Republic of Korea Air Force Base, Kim Hae, South Korea. These tests demonstrated that this New Harvest Eagle system provided significant manpower savings and a high productivity potential. Further, the system was highly accepted by Air Force diners and foodservice workers, as well as by senior Air Force

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officers. Documentation substantiating these findings are provided, as are recommendations for further system refinements and final implementation.

PREFACE

The authors of this report acknowledge with appreciation the efforts of the many contributors from various locations, interests, and levels of responsibility to the successful field testing of the New Harvest Eagle field feeding system, which has since been accepted by the Air Force.

The evaluation of the New Harvest Eagle was the culmination of a three-year program to meet an Air Force requirement for a manpower efficient field feeding system. The requirement, identified as AMAF 81–20 (III) was met. Indeed, Air Force senior officers have indicated the system exceeded Air Force exercise requirements on its first deployment.

The evaluation phase reported in this volume included a feasibility/operability test at Eglin Air Force Base, FL, and a full-scale field test at Exercise Team Spirit '81, conducted at a South Korean Air Base, Kim Hae, South Korea. The work was completed under DA Project 1L162724 AH99, Tech Effort AA, Analysis and Design of Military Feeding Systems.

During the Eglin test the Air Force Engineering and Services Center (AFESC) located at Tyndall Air Force Base, FL, provided valuable assistance in the form of guidance, liaison with Air Force units, and support personnel. As project sponsors, LTC George Murphy, LTC Ron Stump and Mr. Roger Merwin of the Center were extremely helpful. LTC Stump and Mr. Merwin, also participated in the data collection at the Korea evaluation. The Center's training detachment located at Eglin Air Force Base, FL made an essential contribution during the initial fielding and testing of the system. The detachment, under the command of CMS Harlan Catlett, gave engineering and foodservice support of the highest caliber during the Eglin test. The professionalism of these senior Air Force non-commissioned officers was outstanding. Additionally, at the Korean evaluation, SMS Richard Comi of the detachment gave valuable training assistance.

The overseas evaluation of the new system was approved by and coordinated through Headquarters personnel of the Pacific Air Forces (PACAF) Commanding General, LT GEN James D. Hughes; staff officers COL Robert R. Reining, Jr. (DCS), MAJ George Thompson (LGTT), and CPT Richard Moriyama (DEHS) gave valuable guidance and support in completing the myriad of tasks required by the evaluation. The NLABS project team extends its sincere appreciation for the total cooperation received from the PACAF Commander and his staff.

The team also conveys its appreciation and congratulations for a job well done to CPT John Hieser and his Prime Beef Unit, who provided the engineering support during the Korean exercise test. To the foodservice people under the direction of 1LT Frank Furs and MSGT David Copeland we are perhaps most indebted since their enthusiastic and competent performance was the sine qua non of the successful fielding of the New Harvest Eagle.

The primary Natick Research & Development Laboratories (NLABS) project team members were Mr. Philip Brandler, Project Manager; Dr. Eugene M. Nuss, Principal Investigator; Mr. George Turk, Equipment Specialist; and Mr. Joseph M. Wall, Operations Analyst – all from the Operations Research and Systems Analysis Office; and from the supporting laboratories,

Mr. Domenic Bumbeca of the Food Engineering Laboratory (FEL); Mr. Ernie Saab of the Aero-Mechanical Engineering Laboratory (AMEL); and Dr. Lawrence Symington of the Science and Advanced Technology Laboratory (SATL). The team is grateful to all NLABS personnel whose support and contributions made possible the successful conclusion of this project. The complexity of the project required many areas of expertise and numerous personnel from the supporting laboratories, installation services and offices. The cooperation and collective effort of the NLABS personnel is recognized by the team, and though their names are too numerous to include here, their individual efforts are nevertheless appreciated.

Lastly, recognition and appreciation are extended to persons who made special contributions to the project:

Ms. Phyllis Bernstein for her editorial assistance with this report;

Mr. James Prifti (FEL) for his assistance during the Korean test;

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Mr. Richard LaFerriere (ORSA) for his assistance with data collection at the Korean test;

Mr. Thaddeus Bonczyk for modifying, installing, and supervising the remote tank burner system at the Eglin test; and

Dr. Robert J. Byrne, the Chief of the ORSA Office, for his understanding and generous support throughout the project.

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INTRODUCTION

Three distinct project phases were scheduled to accomplish Joint Service Requirement AMAF 81–20 (III)* prior to engineering development and preparation of procurement packages for system acquisition.

In phase I, a comprehensive analysis was conducted of Air Force operational field feeding requirements under mobility conditions and means available to meet these requirements with minimal manpower. Three field feeding concepts were developed and presented to the Air Staff. The New Harvest Eagle was chosen as the preferred concept.

During phase 2, the concept was further developed and transformed into a system prototype. Associated operational concepts and procedures were also developed and included as inherent components of the new system. It was at this time that an instructional manual and an OJT program were written.

Phase 3, documented in this report, was the evaluation and definition phase of the project. A test program designed to evaluate the prototype was accomplished to make possible the full definition of the preferred system. Two distinct, though related, activities were planned and carried out: one was a feasibility/operability test at Eglin AFB, and the other, a full scale field test at an overseas exercise, Team Spirit '81, Kim Hae, Korea.

At the Eglin test, the system performed according to expectation, and was viewed favorably by senior Air Force officers and foodservice workers. Several refinements to the system were recommended to enhance its performance. Refinements to the system were made and it was then packed and shipped to the Korean exercise.

At the overseas exercise, a large scale program of data collection was accomplished to evaluate all aspects of the system, emphasizing its productivity and customer acceptance.

Included in this report is a description of field test procedures and results from both the Eglin and Team Spirit '81 tests as well as recommendations to the Air Staff based on these evaluative data.

*Beginning in October 1980, MSR USAF 9–1 was redesignated AMAF 81–20 (III).

INITIAL FIELDING RESULTS AND RECOMMENDATIONS

The initial activity of the evaluation and definition phase was the fielding and testing of the system prototype. It provided for the assembly and integrated operation of the various subsystems for the first time and, in effect, transformed a design concept into an operational system. When completely assembled, the new system bore little resemblance to the standard Harvest Eagle. Consequently, it was deemed appropriate to substitute "New" for "Modified," renaming the system the New Harvest Eagle.

PURPOSE

Principal objectives of the initial fielding at the Eglin AFB training site were to test the operability and feasibility of the New Harvest Eagle prototype. The design of the initial feeding activity provided for a configuration of the subsystems of the Eagle into a functional whole and directed the testing of each subsystem and its components for operability and collectively as system elements for their feasibility. Consistent with prototype test procedures, all elements of the system were viewed as open to possible modification, replacement, or elimination based on test findings.

Data collection of a formal/systematic nature during the initial fielding was planned for several key areas only, including the electrical requirement, fuel and water consumption, system safety characteristics, workers' opinions, and customer reactions. It was anticipated that extensive detailed data collection would be accomplished later, during the evaluation of the system at an Air Force exercise where a large customer population would make productivity and stress tests of the system possible. Other data were to be collected during the initial fielding to describe the reliability of the equipment, the utility of the design configuration of the shelter, and the temperatures in the kitchen and dining areas.

Documentation of the system during erection/assembly and operation was included in the field test plan. Both videotape production and the writing of procedural manuals were provided for. These materials were to serve primarily as future references to personnel who would be tasked with the erection and operation of the system, and as training aids for Air Force foodservice engineering personnel. They were also viewed as having value in future system evaluations, and, of course, in presentations of the New Harvest Eagle System in both scientific and public relations contexts.

Introduction of the New Harvest Eagle prototype to Air Force technicians and planners was considered an important goal of the initial fielding. Air Force technicians in the engineering areas as well as foodservice people were located at the site of the initial fielding, and it was planned that these people would acquire the knowledge and skills to erect and operate the system as they worked with NLABS experts in the fielding activity. Tactical Air Command Headquarters was invited to send a cadre of foodservice and engineer personnel to the fielding to learn to operate the system at a future TAC exercise. In this manner, the technical and managerial expertise (a requisite to system operation) would be passed on to the Air Force. Also, Air Force planners assigned to the Air Force Engineering and Services Center (AFESC), located near the fielding site (Tyndall AFB), would have an opportunity to observe the system in operation and to offer their views to the NLABS project team.

PLANNED SCHEDULE

The location offered by AFESC at Field #4, Site B–2, Eglin AFB was an ideal location for the feasibility test. The site is used to train Prime Beef engineer teams from various bases. The trainees arrive by aircraft, have no private vehicles, and are billeted and fed on location. Approximately 100 people constitute a class; each class receives five days of training. On the first and last days of the session, they subsist on C-rations; on the other days, A-ration meals are served from a Harvest Eagle kitchen. The permanent cooks are Red Horse cooks on loan to the site. The training program also provides for training foodservice personnel, called Prime Ribs, in all aspects of field foodservice activity. The plan was to have the New Harvest Eagle assembled near the existing kitchen. The NLABS shelter, equipment, and supplies, supplemented by the cooking and serving utensils from the existing Harvest Eagle, constituted the foodservice complex.

The time frame for the initial fielding of the New Harvest Eagle, 15–30 June 1980, was selected because it coincided with a break between classes at the training site, allowing the training staff to be available to assist in the assembly of the system. Other considerations were that ample time was allowed for the receipt of the shelter, equipment, and supplies, and that the break was followed by back-to-back classes, allowing a period of continuous feeding.

Three groups were assigned responsibility for the assembly of the New Harvest Eagle. Several organizations within NLABS played major roles in the assembly of the system: the Operations Research Systems Analysis Office (ORSAO), responsible for overall activity; the Food Engineering Laboratory (FEL), responsible for equipment assembly and operation, electric service, and plumbing; the Science and Advanced Technology Laboratory (SATL) responsible for data collection in the human factors, customer reaction, and workers' opinion areas; and the Aero-Mechanical Engineering Laboratory (AMEL) responsible for shelter and lighting requirements. The A.D. Little, Inc., (ADL), under contract to NLABS, provided personnel who were responsible for documenting the system in operation using the videotape method, for collecting data for erection, assembly, and operational manuals, and for management and OJT programs. The engineers of the AF Engineering and Services Center (AFESC) assigned to the Eglin AFB training site provided technical manpower support. Official Air Force visitors were encouraged to view the system and to receive briefings on 30 June 1980 which was planned to be the last feeding for the second class to be fed in the New Harvest Eagle.

During the period of the prototype test, classes were scheduled back-to-back. Thus, the first class departed and the second class arrived on 27 June 1980. Based on that schedule, three meals were served each day on 24, 25, and 26 June, and on 28, 29, and 30 June 1980. To allow sufficient time to assemble the system, briefings were begun on 17 June 1980 (see Table 1).

The AFESC planners requested the prototype remain at the test site for further use by the staff beyond 1 July and to permit visitors to view the system in operation. It was agreed that Air Force would operate the system independently for a brief period (30–60 days) and the NLABS personnel would return to the site to debrief the operators and to assist in packing and shipping the system back to NLABS.

Table 1

A Schedule of Activities for the Initial Field Testing of the New Harvest Eagle at Eglin AFB, FL June 1980

Activity	Responsible Personnel	Date
1. Briefing of ESC personnel	NLABS	17 June (am)
2. Overview of ADL activities	ADL	17 June (am)
3. Shelter erection/kitchen	NLABS/ESC	17 June (pm)
4. System erection/assembly	NLABS/ESC	18 June (am)(pm)
5. Videotape production of procedures to erect, strike, and pack the storage shelter	ADL/ESC	18 June (am)
6. Videotape production of system erection/assembly	ADL/ESC	18 June (pm)
7. System assembly/operation	NLABS/ESC	19 June (am)(pm)
8. Videotape production of system erection/assembly	ADL/ESC	19 June (am)(pm)
9. Review of management, OJT, and equipment manuals	ADL/ESC/NLABS	20 June (am)
10. System test operation	ESC/NLABS	20 June (pm)
11. Videotape editing	ADL	21 June
12. System test operation (debugging)	ESC/NLABS	21 June (am)
13. System test operation (debugging)	ESC/NLABS	22 June
14. Videotape editing/production as required	ADL	22 June
15. Final preparation for system operation	ESC/ADL/NLABS	23 June
16. Working dinner for team members – ADL videotape viewing, if feasible	ESC/ADL/NLABS	23 June (pm)
17. System operation – breakfast, lunch, dinner	ESC/NLABS	24–26 June
18. Critical observations emphasizing management and OJT requirement	ADL	24–26 June
19. Review of operations	ESC/ADL/NLABS	27 June (am)
20. System operation – breakfast, lunch, dinner	ESC/NLABS	28–30 June
21. Out briefing	ESC/NLABS	30 June

SUMMARY OF ACTIVITIES

On the morning of 17 June 1980, a briefing was conducted by the Project Principal Investigator for USAF personnel who would erect and operate the New Harvest Eagle. Also present were the NLABS team members and representatives of Arthur D. Little, Inc. The briefing took place in a classroom at Site B–2, Field 4, Eglin AFB, FL.

The Principal Investigator began the meeting with an introduction which included identification of the team members, the purpose of the prototype test and its operation, and a 19-minute video tape outlining the background and progress to date of MSR USAF 9–1.

The Arthur D. Little, Inc., (ADL) project leader followed and explained that they were there as an extension of the NLABS resources, and more specifically, to update and get feedback on the operational manuals that are to accompany the system in future testing, to document the system via videotape, and to discover the training needs and the materials required to satisfy those needs.

The staff at Site B–2 had previously laid the required plywood flooring for the kitchen and the sanitation portion of the system. It was decided that the kitchen shelter would be erected first so as to allow the electricians and plumbers as much time as possible to accomplish their tasks. The frames and blankets for the TEMPER (tent, extendible, modular, personnel) shelter were still in the shipping containers. Under the direction of the AMEL representative, the five section kitchen shelter was erected in one hour and 10 minutes by personnel who had no previous experience with the TEMPER. Shelter erection included the time consuming task of separating the shelter components from the manufacturer's shipping packages. A vinyl floor covering previously fitted with Velcro at NLABS was installed. After installation of the tent liner and flourescent lighting, the equipment was positioned.

The sanitation/preparation/storage shelter was erected next. This shelter was erected in two four-section pieces, which were joined by four workers and one supervisor to demonstrate erection with a minimum number of people. During the erection, a rain storm occurred with winds measured at 37 mph. The kitchen shelter, which had been erected, and the sanitation/preparation/storage, which was up, but not secured, were unaffected.

While the sanitation/preparation/storage shelter was being erected, the lines were being laid for the fuel and plumbing systems. The burner system consisted of the air compressor and its line to the two 60 gallon fuel tanks. Lines from the fuel tanks led to the 13 burners in the kitchen and to the one burner under the sanitizing sink. A 1,000 gallon water tank was in place. The lines from it led to the water meter and then to the water heater. Hot and/or cold water lines were then laid to the coffee brewers for the dining area, to the kitchen for the hand washing sink and for the pot filler, and to the three sanitation sinks and vegetable washing sink in the sanitation/preparation/storage shelter. Drainage lines were laid to a grease trap located just outside the sanitation/storage shelter adjacent to the sanitation sinks.

The dining shelter erection was scheduled to be documented with videotape under the auspices of Arthur D. Little, Inc. All phases from unpacking the components through the

final tie down were recorded in detail. With the shelter erection completed, the video crew proceeded to document the outdoor type equipment: the fuel system, grease trap, water pump, and the heaters. On the second day, they filmed the inside equipment and its operation. This included the griddles, the steamtables, the warming cabinets, the ovens, and the tilt fry pan. The process of heating and opening the T-ration pans was recorded; customers being served and consuming their meals in the dining shelter were also taped.

Prior to erecting the dining shelter, the commander of Site B–2 advised that they had on hand sufficient AM–2 matting that is used for rapid runway repairs and that he would like it to be used as flooring in the dining shelter. Although no flooring was planned for the New Harvest Eagle dining shelter due to cube and weight factors, it was agreed that for this operability test it could be installed. The dining area is less important in regard to flooring as no heavy equipment is located there nor are workers for any protracted time. Using Prime Beef trainees, the floor was laid in about 30 minutes.

Two types of lighting were used. In the kitchen, flourescent lights in explosion proof plexiglass were used. In all other areas, the standard Harvest Eagle incandescent lights were installed.

On the fourth day after NLABS personnel arrived at Eglin, Friday, 20 June 1981, all components of the system were activated and the system was fully operational. Less time would have been needed had there not been delays required for staging activities for the videotaping.

In regard to the operation of the system, all components operated as designed without any difficulty. Of the commercial equipment, only the vegetable slicer/grater/shredder was not used. Because of the relatively small number fed and the serving of a T-ration meal, the cooks preferred to do the salads by hand. All other items of equipment were used.

The dining shelter accommodated the customers comfortably. In general, the 100 customers were served during a 20 minute period. The kitchen shelter provided ample room for workers. The serving lines were off center relative to the entrance, in order to have the exhaust stacks line up with the screened vents in the ceiling liner. The sanitation shelter configuration provided a smooth flow for soiled items through the cleaning, sanitizing process into convenient storage for pick up by the cooks. The preparation area also proved useful in removing food products from their packaging and preparing salads. The storage area was more than sufficient for this size feeding requirement. The all-indoor location was especially appreciated during frequent rain storms.

During the course of the initial fielding, a number of people came to observe the operation first hand. Among these was the Director of Engineering and Services, HQ, USAF who said that having seen many field feeding systems, he considered the New Eagle to be "the best." Planners from 9th Air Force Shaw AFB, SC, visited and expressed interest in using the system at a TAC exercise scheduled for Ft Bragg, NC. The officer in charge of the training site also visited and expressed satisfaction with the system.

On the final day of the NLABS presence at the Site B–2 fielding, an out-briefing was given by the USAF 9–1 Principal Investigator to key military and civilian policy makers from the Engineering and Services Center at Tyndall AFB.

A chronology of activities during the initial fielding was presented to the group, distinguishing characteristics of the system were identified, and results of the initial fielding thus far were discussed. High praise was directed to the AFESC training staff who assumed the major burden of erecting/assembling and operating the field kitchen prototype. The possibility of the future deployment of the new system was explored with only exercises in Alaska and Korea identified as possible sites during FY81. Air Force people again expressed their desire to keep the prototype at the Eglin training site for an indefinite period. The briefing was concluded by a tour of the facility.

OPERATIONAL RESULTS AND REFINEMENTS ACCOMPLISHED

A summary assessment of the New Harvest Eagle prototype was offered in a Letter of Appreciation (see Appendix A) to NLABS from the USAF Representative on the Joint Technical Staff of the DoD Food RDT&E Program, which stated: "The entire Modified Harvest Eagle system functioned remarkably well, especially for a system assembled for the first time. Everything worked! The Air Force was especially happy with the system." Senior Air Force officers who visited the prototype operation were enthusiastic in their overall appraisal of the system. The Director of Engineering and Services, in particular, commented on the relative superiority of the prototype (to previous systems).

Data collected from food service personnel who used the system and from customers who were served by the system indicated high acceptance of the facility and its service. High acceptance of the new system by the Eglin foodservice personnel is of particular significance since they were field feeding experts. A human factors evaluation of the system showed it was clearly far superior in all aspects to the field feeding complexes observed in previous Air Force exercises. (See Appendix B for the complete report on Customer and Foodservice Worker Opinion, including a Human Factors Summary.)

In the context of feasibility and operability, the New Harvest Eagle prototype was found acceptable. The system functioned well; its design and operation characteristics were satisfactory. It is the consensus of persons familiar with Air Force field feeding requirements and the new system that it will succeed. Further specific observations and recommendations for refinements to particular subsystems resulting from this initial feasibility test are presented below.

The Shelter System

Erection and installation procedures were found to be satisfactory and are documented in a training videotape and in Section A of the Instructional Manual.* These procedures include erection of the kitchen, sani/storage, and dining shelters, and attachment of the protective vestibules. Lighting installation procedures are detailed for the kitchen and sani/storage shelter areas, as are instructions for placement of the kitchen liner panels.

*An instructional manual for the New Harvest Eagle field feeding system is published as NATICK/TR–82/034.

The shelter system withstood high winds (40 mph) and heavy rain (three inches per hour) with only minor problems. Some rain water did appear along the inside stitching in the shelter fabric and water pocketed on the vestibule roof.

Customers were extremely complimentary about the dining space and environment provided by the shelter system where effective temperatures* ranged from 67° to 86° Fahrenheit (F), but this comment was viewed in the context of high ambient temperatures. Similarly, the cooks were positive about the amount of workspace provided by the kitchen shelter and the provision of a connected, covered sanitation and storage area. The cooks did express concern about the effective temperatures in the kitchen which ranged from 78° to 104°F, a concern supported by a human factors evaluation.

Improvements to the incandescent light system were proposed by the ESC chief electrician. He proposed a blackout capability, a plug/socket hookup, a three-wire grounded system, waterproofed components, and lens covers for fixtures in food preparation areas.

Other plans for shelter refinements considered were increased visibility of door screens to avoid walking into them, fly traps located in vestibules, close ties to replace Velcro at the bottom of the shelter, a fan to reduce temperature in the kitchen, aluminum "bump through doors" for vestibules, and flourescent kitchen lights with higher heat tolerance levels.

Upon its return to NLABS, certain refinements were made to the shelter including the addition of aluminum "bump through doors" to the main diner entrance vestibule and to one of the two diner exit vestibules. It was felt that the doors would afford temperature, dust, and insect protection to the diners.

The fluorescent lighting for the kitchen shelter was re-engineered by the manufacturer to raise its heat tolerance level. At the Eglin test, the lights failed when exposed to the very high temperature which occurred directly over the serving line. Due to time constraints imposed by the early date of the overseas exercise, and in part due to the fact that high ambient temperatures at the Korean test, scheduled for March, were not anticipated, further temperature refinements of the shelter system were postponed.

For the Korean test a one-piece vinyl floor covering for the kitchen shelter, fabricated by AMEL personnel, replaced the sectioned covering used at the Eglin test. Cooks reported the Velcro seams where sections were joined caused tripping and were difficult to clean. A similar one-piece covering was made for the sanitation area.

The Remote Tank Burner System

With Air Force concurrence, the remote tank burner system was modified at the test site to permit lighting the burner units in place. This eliminated carrying the units from a

*Effective temperature is a combination of dry bulb and wet bulb readings.

central location to the appliance to be heated, and also resulted in a simpler system, i.e., fewer valves, fewer handles, and no mini-tank previously required to keep the burner burning while in transit.

The system worked without problems during the initial three weeks of operation. Cooks readily learned to activate, light, and control the system and to deactivate the system at the close of the work day. The cooks were very positive about the burner system, particularly those with M–2A burner experience (86% of these cooks preferring the new system to the M–2A). The main advantages of the new burner system seen by the cooks were increased safety and the elimination of the requirement for frequent filling. Over 3,000 meals were served during the three week period.

During the joining of the quick disconnect couplings on the fuel lines, very small amounts of gasoline were ejected from the lines. This condition indicated that an improved quick disconnect coupling was required.

After the departure of the NLABS project team, a fire incident occurred in a burner unit located in the sani/storage shelter. This burner was used to maintain sanitizing water temperature in the final rinse sink of the sanitation system. The burner was remotely located and apparently was ignored at evening shutdown time. A valve was left open, which permitted gasoline to enter the system prematurely when the system was activated the next morning.

The burner system was modified after the Eglin test by the addition of a safety valve located in the fuel line of each burner unit. The function of the valve was to close the fuel line whenever there was a significant loss of pressure in the line, such as would occur when the system was shut down and to require manual resetting when the system was to be reactivated. It was believed that the design of the valve would prevent fire accidents of the type which happened at the Eglin test site. The valve, Model No. HV218982, was manufactured by the Automatic Switch Company of Florham, NJ, and installed by FEL personnel. Improved quick disconnect couplings were installed on the fuel lines. The couplings sealed the line before actual connections could be made or separated, thus preventing the ejection from the line of small amounts of gasoline which did occur with the original connections.

Minor changes were made in the configuration of the various attachments located on the remote gasoline tanks and a protection frame constructed around projecting gauges and fittings. A protective frame was also built around the air compressor. A statement authorizing the burner system to be operated at the overseas exercise was issued by the NLABS Safety Officer prior to the shipment of the system to Korea (see Appendix C).

The Sanitation System

The automatic hot water heater worked well and produced ample hot water (up to 190°F). The water pump ran without problems. The Air Force ESC chief electrician recommended that a water demand switch be added to shut off the pump when no demand exists.

The three sinks with faucets and attached scraping/draining tables proved to be an acceptable arrangement. Workers who used the system found it convenient to use and spilled

only a very minimum of water on the floor. One of the sinks was the sanitizing sink and water in it was maintained at a 180°F minimum by a burner unit. The heat from the burner created discomfort for the worker at that sink and was judged to be unacceptable in a human factors evaluation. A heat shield for the "sani" sink was therefore fabricated and installed.

While the plumbing system worked without fail, it was apparent that quick connect/disconnect couplings would be preferable to the permanent couplings. Quick disconnect couplings were installed in the water lines prior to overseas shipment.

Some dissatisfaction with the grease trap was expressed by several cooks and minor modifications pertaining to baffle size were considered. However, these changes were not made prior to the overseas test.

The sanitation system was evaluated by the Chief of Veterinary Services, 23rd TAC Hospital/SGV. His comments and recommendations are included here as Appendix D. The opinion of this officer was that the prototype represents a significant advance in field sanitation, safety, and operation, as compared with previous units.

Food Preparation Equipment

The food preparation equipment operated as designed and anticipated. The three-well steamtables with gasoline burners operated satisfactorily and kept the food at serving temperature. Observation and cooks' comments indicate a larger (four-well) unit would be an advantage when serving large numbers. The original plan called for using existing electric four-well food holding tables, but this plan was abandoned since only one was available at the site. Removable one-well extentions to the steamtables were fabricated at NLABS for later use at the Korean test.

The griddles performed as expected. However, several cooks reported that burns were received from the handle of the grease trap plug and from the lip of the griddle which attain the same temperature as the cooking surface. They also reported that the heat coming from the grease outlet when unplugged retarded their freedom of hand movements. As a result, the handle of the grease trap plug was subsequently cut down by NLABS personnel.

The NLABS developed oven operated as expected. However, since a relatively small group was served, oven use was minimal. The cooks were disappointed to find that the standard sheet pan would not fit in the oven. Standard items are generally preferred, and it is recommended that the oven be enlarged to accommodate the standard pans.

The tilt fry pan was a favored piece of equipment among cooks. It is a versatile piece of equipment and easy to operate. Tray packs were most frequently heated in the tilt pan.

The reach-in refrigerator for use with the short order line was thought at first to be too large for its intended use. However, after all the equipments were in place, it seemed to fit better. Since there was no large scale short order service, judgement could not be made as to its adequacy from this experience.

The warming cabinets are insulated and have dutch doors. Observers reported that the outside surface was too hot to touch and the handles were somewhat difficult to operate. The unit operates with a timer switch rather than a simple on/off switch, and this confused some individuals.

The deep fat fryer operated as expected. Concern was expressed regarding the fire hazard associated with this kind of equipment. No specially designed or automatic fire suppression system was provided. One suggestion was to construct a sheet metal hood that would deflect flames should a fire occur. The unit is located in a corner of the shelter affording protection to the worker and does not encumber any exit.

Next to the deep fat fryer is the proximity ventilator. This unit exhausts the deep fat fryer to the outside. Its operation was satisfactory, and the side exhaust concept appears ideal for field adaptations.

The five-pot coffee makers produced a consistently high quality product while operating automatically. Adjustments were made to both the serving temperature and the quantity dispensed. After the Eglin test, coffee dispensers with adjustments to vary the amount of coffee to be automatically dispensed were added. The instructions with the machines are sufficiently clear, allowing these adjustments to be made by the operator.

The vegetable slicer was not used. This piece of equipment has high volume capability which simply was not required for the 100 people being fed.

Two models of a french fry machine using a dehydrated product were used, the Frispo automatic model and the Frispo-ette, a manually operated model. A representative of the American Potato Company came to the site to demonstrate the units. At first, it appeared that the manually operated unit was preferred; however, after cooks used the automatic model, they much preferred it.

The pot cradles with cowling added seemed to increase the efficiency of this heating method, and the majority opinion was that all pot cradles should be so modified.

The sink placed in the kitchen was used for its intended purpose, hand washing.

Overall, the equipment operated without major difficulties. No repairs or maintenance were required during the initial fielding. When interviewed by the NLABS Behavioral Scientist, all but one of the cooks volunteered favorable comments about the equipment. The Air Force ESC electrician who did the wiring noted that electrical load peaks of 36 kilowatts (kw) were measured, thus giving confidence that the system as configured can be serviced by a 60 kw generator.

The system was evaluated by the Chief, Sanitation and Hygiene Section, US Army Environmental Hygiene Agency. His comments were highly favorable. These along with his recommendations are presented in Appendix E.

The Field Menu

During June 1979, the Engineering and Services Center, Air Force Services Office, published a 31-day field feeding menu. The first 10 days of the menu called for use of meal, combat individual (MCI) and/or food packets, inflight (IF), while the next 21 days provided standard fare. During July 1979, the menu was adapted for this project by substituting T-rations for the items on the dinner meal. Using that adapted menu, orders were placed for T-rations to serve 150 men for 10 days.

The breakfast menu provided eggs to order, breakfast meats, hash brown potatoes, creamed beef, assorted cereals, fruits, and beverages. The lunch menu offered two entrees, a starch, two vegetables, and two desserts. Three salads, fruits, slaw or cottage cheese, and assorted beverages were also available. The dinner menu was exclusively T-ration and served two entrees, two vegetables, one starch, and three desserts. Beverages and bread were available in the dining shelter. No salads were served with the T-ration meals.

The T-ration tray packs were heated in the three pieces of kitchen equipment included for T-ration heating. Two equipments heating water for tray pack preparation were the tilt fry pan (18 trays) and the 15-gallon stock pot (8 trays). The oven (12 trays), using hot air, required the containers to be punctured prior to heating. On a time basis, the water method is preferred. Come up time for boiling water was 15 minutes while the ovens took 45 minutes to reach 350°F. In the 350°F oven and in the boiling water, a product serving temperature of 165°F required 30 minutes for entrees, 15 minutes for starches, and 10 minutes for vegetables.

Short order service was only provided intermittently due to the relatively small number being fed.

From all indications, the menu was very acceptable, and changes from the basic concept are not necessary or desirable. Customer acceptance data are displayed in Tables B2 and B3 in Appendix B of this volume. All items rated by customers were found acceptable as indicated by mean ratings.

PREPARATION FOR OVERSEAS EVALUATION

At the conclusion of the Eglin feasibility evaluation, the system, including the shelter, was loaded on the NLABS 40' trailer for the return trip to Natick. The van was offloaded, and the kitchen portion was reassembled. All the equipment was checked as to condition, and the refinements as previously described were commenced. As this was the first time the system in its complete form had been assembled at Natick, people from the various branches at NLABS, including the Installation Commander, used the opportunity to visit and appraise the system.

During the interval between field tests, a concerted effort by NLABS Project Team members, the NLABS Procurement Division, in close cooperation with AFCOMS people and personnel from the 62nd Aerial Post Squadron, McChord AFB, resulted in the successful

procurement and delivery to Korea of 1,463 cases of T-rations. An additional 25 cases of a T-ration dessert item, packed at NLABS, were airlifted to Korea to supplement the commercially packed items.

Special guidance and supervision were given to the three commercial packers of T-rations by an NLABS packaging expert. Written packing and shipping instructions were provided for the packers by the expert. The NLABS packaging expert also visited the packer to insure product quality and acceptance standards of packing and shipping.*

The entire New Harvest Eagle, with the exception of 18 burner units, was packed in a 40' sea land container. Also packed in the container were 40 cases of potato product for use with the Frispo-Matic and 100 cases of GSA compartmented paper trays. The container was hauled to the terminal from where it traveled by rail to the west coast, by ship to Pusan, Korea, and then over land to the test site at the Kim Hae ROKAF Air Base.

Close coordination was continued with PACAF/HQ personnel in the interest of a successful evaluation of the New Harvest Eagle system. System characteristics and constraints were communicated to PACAF and concerns raised by the Air Force and NLABS were resolved. Special attention was paid the new elements in the system to preclude misunderstanding and to encourage their acceptance during the evaluation (see Appendix F, an example of this type of communication).

All pre-evaluation tasks were completed. On 4 February 1981, a team of four NLABS experts, including the Principal Investigator who directed the team effort, a shelter expert, an equipment expert, and a food service expert departed for Team Spirit '81.

*Nearly 1,500 cases of T-rations were shipped to Korea directly from the packers. The rations arrived at the Kim Hae site in perfect condition. Packing and shipping procedures are documented in Section X in the Instructional Manual and are highly recommended for future T-ration shipments.

OPERATIONAL TESTING AT TEAM SPIRIT '81, KIM HAE, KOREA

The New Harvest Eagle system arrived at its Korean destination on time without damage or loss of items. Upon arrival at the exercise site, Kim Hae, the system was off loaded and placed in the warehouse where Harvest Eagle kits belonging to the Pacific Air Force are stored and maintained. The remote tank burner system and certain electrical items which had been shipped separately to Korea were also in the Harvest Eagle warehouse. The entire order of T-rations was shipped directly from the packers through Travis AFB, CA, and from Travis to Korea on military aircraft. When the NLABS team arrived at Kim Hae, the T-rations were at Kunsan AFB, Korea, the support base for Kim Hae; these were delivered to Kim Hae a few days later. Elements of the standard Harvest Eagle warehoused at Kim Hae were identified and added to the New Harvest Eagle complex, as had been planned. All components of the New Harvest Eagle food complex were in place on schedule and readied for assembly and operational testing.

The sections which follow in this report present the findings and implications of the field evaluation implemented during the Team Spirit '81 exercise. All subsystems and specific items in the Harvest Eagle prototype were evaluated and analyzed. Data were collected on all aspects of the foodservice operation. The principal purpose of the full evaluation was to ascertain the extent to which the new system could achieve the purpose for which it was designed, i.e., to permit significant manpower savings while providing acceptable foodservice to troops in the field. Acceptable foodservice was defined as a customer acceptance level at least as high as measured at earlier exercises, and worker morale as high as previously measured.

System efficiency and customer acceptance were the major targets of the evaluation design; worker morale was measured inferentially from personal interviews with cooks. These subjects are discussed below in the general context of findings, implications, and recommendations.

NEW HARVEST EAGLE SYSTEM PRODUCTIVITY AT TEAM SPIRIT '81

Validation of the adequacy of the prototype foodservice system was contingent upon a favorable operational evaluation in an environment similar to one for which the system was designed. Therefore, the New Harvest Eagle (NHE) field feeding system was deployed to Kim Hae, Korea to be fully evaluated as a forward base field feeding system while subsisting a troop deployment at exercise Team Spirit '81.

It was thought that the Kim Hae site was ideally suited to test the New Harvest Eagle. The anticipated deployment size of 1026 troops was virtually the same as the prototype design size, i.e., 1100 troops, and, in part due to previous NLABS study of an overseas exercise, a meal attendance rate of 70% was projected.

Based on the above expectations, it was anticipated the NHE would serve some 2100 meals daily, well within its 3000 daily meal design capacity, but a sufficient number of meals to test system efficiency under stress.

The evaluation strategy was designed to examine the relationship between the number of foodservice personnel deployed to previous similar exercises and the number of personnel

actually required to subsist the Kim Hae deployment. The experimental design further provided that productive and non-productive man-hours for the workforce be determined and these hours be examined in context with the number of meals produced. System productivity was necessarily the central focus of the study, given that manpower savings was the system's ultimate objective.

Estimates of NHE productivity were based on projections of required conditions for efficient system operation. For example, the production of a minimum number of meals was required to judge total system capacity. A shift of 12 hours and a six-day work week was necessary to test foodservice worker capability. Innovative shift scheduling was recommended to prevent excessive shift overlapping while preparing and serving four meals per day. Menus were designed to optimize equipment use and personnel utilization. An OJT program was designed and introduced to foodservice management. Further, it was assumed that only foodservice people would be assigned to the field system, and that each worker could with appropriate training perform all required foodservice tasks. It was also assumed that managment at the foodservice facility would accommodate to requirements of the NHE evaluation when such would not interfere with the overall exercise mission. The above expectations were communicated by NLABS to relevant parties at the operational Command Headquarters and to the Air Force sponsor of the study, AFESC. Many of the required conditions were not met in varying degrees. Further, the major constraint, that of a high meal attendance rate, did not obtain. Only a 39.8% rate was recorded compared with the 70% anticipated rate. Thus, the new system was able to meet the subsistence needs of the exercise with less than a full capacity effort.

During 35 days of uninterrupted operation, the NHE served in excess of 24,000 meals. Not a single scheduled meal was missed. During the 15-day maximum activity period, daily meal production averaged 1021 meals, with a range of 883 to 1?51 daily meals. Clearly, the design capacity of the NHE of 3000 meals/day was far greater than the meal requirement at Kim Hae, and therefore, the New Harvest Eagle accomplished its Team Spirit '81 mission without stress, as was observed by Senior Air Force personnel. In his summary statement regarding the New Harvest Eagle's performance, Col Robert R. Reining, Jr., DCS Engineering and Services PACAF Headquarters wrote, "The Modified Harvest Eagle met and, in many instances, exceeded our (PACAF) field feeding requirements at Kim Hae AB, Korea." (See Appendix G for COL Reining's complete statement.)

The ultimate objective of the Military Service Requirement documented herein was to minimize manpower requirements for field feeding at bare base operations while maintaining high standards of foodservice. The quality of the service offered by the New Harvest Eagle is documented in the next subsection of this volume. The reductions in manpower requirements are discussed below. These increased manpower utilization efficiencies are presented as reductions in manpower requirements as set forth by the Air Force Unit Type Code (UTC) for wartime mobilization,* and by comparisons with exercise manning policies of the major operations commands, in particular, those of the Pacific Air Force. A third comparison examines labor savings that could have been realized had all of NLABS recommendations been implemented at the Kim Hae feeding site.

*Quotas are cited for services requirements in "Base Services UTC 4F 9RA, UTC Codes A and B."

The potential manpower savings were documented by a comprehensive work sampling study (the study plan is presented in detail in Appendix H). The major finding in this regard was that during the data collection period, a daily average of 132 productive manhours and 48.5 (26.8%) non-productive manhours (a total of 180.5) were recorded for the foodservice work force. These hours and ratio of productive/non-productive manhours are consistent with manhour projections for the system so as to permit the projection that the manning standard formula is likewise valid. When these manhours are converted to personnel equivalents (180.5/10.3),* it is clear that 17.45 workers afforded the system adequate manpower.

The Air Force UTC for food personnel assumes that the workload to be addressed is a function of the daily average number of meals to be served. Thus, at the Kim Hae deployment where a daily average of 1021 meals were served, the UTC standard would dedicate 26 foodservice personnel. Further, these 26 workers working 12 hour shifts and a six-day workweek would provide 267 man hours of service daily and achieve productivity rate of 39 meals per foodservice person deployed. By comparison, the New Harvest Eagle system served the 1021 daily meals using 180.5 man hours daily or 17.45 foodservice worker equivalents at a productivity rate of 58.51 meals per foodservice worker.

Therefore, as is shown in Table 2 below, efficiency in the New Harvest Eagle produced a manpower savings of about nine workers and made possible a 50% increase in daily meal production rate as compared with a hypothetical application of the UTC manning standard.

Table 2

Foodservice Manpower Savings: New Harvest Eagle/Unit Type Code

	No. Foodservice Personnel			No. Meals Served Per Foodservice Person		
Average No. Daily Meals	UTC Requirement	On Duty Kim Hae	Management Savings	As Per UTC	Served at Kim Hae	Productivity Increase
1021	26	17.45	8.55 (32.8%)	39	58.5	19.5 (50%)

Another useful comparison of manning requirements can be made by citing the manning practices of the Pacific Air Force Headquarters (PACAF) in effect at the time of the Korean study. In Team Spirit '80, for example, PACAF deployed 34 foodservice people to the Kim Hae deployment site. In Team Spirit '81, the same size deployment (as in Team Spirit '80) at Kim Hae was subsisted by a daily worker average of 17.45 worker equivalents using the

*Average daily hours available per worker are calculated as:

$$\frac{12 \text{ hrs per day} \times 6 \text{ work days per week}}{7 \text{ total days per week}} = 10.3 \text{ hrs per day per worker}$$

New Harvest Eagle.* Further, some 33 foodservice personnel were deployed to Sacheon** during Team Spirit '81, a feeding site with a deployment somewhat smaller than that at Kim Hae. An actual savings of 50% was therefore demonstrated by the New Harvest Eagle as compared with PACAF manning practices for the standard Harvest Eagle. Thus, in yet another perspective, the NHE demonstrated its manpower savings potential.

The wartime field work schedule directed by the Air Force requires each worker to be on duty 12 hours each day, six days per week. Thus, each worker is available for duty an average of 10.3 hours each day, i.e., 12(hrs) x 6(days)/7(actual) = 10.3. However, peacetime field feeding practices differ regarding expectations for duty assignments. Each worker is expected to be on duty eight hours per day, five days per week. Here it is seen that each worker is available only 5.7 hours each day: 8 x 5/7 = 5.7. The significant difference in peacetime vs. wartime workload expectations for foodservice people has important implication for manning standards, i.e., peacetime exercises will require more personnel per given size feeding requirement. This concept was demonstrated during the Kim Hae feeding operation as follows.

To test wartime feeding capability of the NHE, the NLABS work sample study assumed a wartime work assignment for foodservice personnel. Under this regimen it was demonstrated that the daily meal requirement could be met by 17.45 foodservice people, as discussed earlier in this report. During the feeding periods not included in the NLABS work sample study, the 26 foodservice people deployed by PACAF to Kim Hae operated the system. Their work schedule followed the peacetime norm of an eight hour work day and five day work week.

Even under this regimen the NHE operating on a peacetime work schedule showed a 23.5% manpower savings as compared with an equivalent feeding requirement at an earlier exercise (see Table 3), and a 21.2% savings compared with a similar feeding requirement at another feeding site during Team Spirit '81.

In summary, significant manpower savings were achieved by the New Harvest Eagle system as compared with previous exercise manning levels when compared with the UTC manning standard. The maximum productivity of the New Harvest Eagle could not be validated at Team Spirit '81 due to the low meal attendance rate. However, factors identified as unique to the NHE system had a significant effect on foodservice productivity and permitted the manpower savings just identified.

*It should be noted that based on the NLABS manning formula, PACAF was requested to send only 17 foodservice people to be the core group and 8 supernumeraries as backup in the event of exercise contingencies or system failure. Eventually 26 workers were assigned to the Kim Hae foodservice operation. However, it was demonstrated during the NLABS work sample study that 17.45 workers were adequate to service the troop deployment.

**Sacheon was an exercise site in Team Spirit '78 as well as in Team Spirit '81, and was one of the overseas exercise sites evaluated during the initial data collection phase of this study.

Table 3

Manpower Savings of the New Harvest Eagle as Compared with the Standard Harvest Eagle

	Standard Harvest Eagle at Team Spirit '80	New Harvest Eagle at Team Spirit '81	New Harvest Eagle Manpower Savings
Feeding Level	1032	1021	
Number Food Service Personnel	34 (Actually deployed)	26 (Actually deployed)	8 (23.5%)

Significant gains in system efficiency were realized by serving a daily T-ration supper meal. Over 30% of all meals served at the exercise were T-rations, yet only 17.8% of the total productive worker hours were expended on preparing them and T-ration work shifts were recorded as non-productive 34% of each of their shifts against an overall non-productive rate of 26%. The non-productive time for cooks on the dinner meal shift would, in fact, have been much higher, and productive time much lower, if shift management had been efficiency oriented. For example, on 16 March, four cooks were positioned on the double serving lines and each was recorded as being productive two hours during the two and one-half hour dinner meal period. Those four cooks served a total of 276 cutomers their dinner meal, i.e., they served fewer than one customer per minute. Clearly this was a case of overstaffing as the task could have been accomplished with fewer personnel on that shift.

The remote tank burner system saved many hours of maintenance labor. Only 1.6 hours of burner maintenance were required each day in support of an average of 1021 meals per day. This compares highly favorably with an average of 8.5 hours of daily burner maintenance expended at two overseas exercises where meal production averaged 930 meals per day and where standard M-2A burners were used. The appropriateness and layout arrangement of equipment in the NHE kitchen were also rated high by foodservice workers and undoubtedly contributed to system efficiency. When foodservice workers who had previous field experience compared the New Harvest Eagle with the Standard Harvest Eagle, ease of equipment usage was rated higher in the NHE, the result being more efficient operations (see the following subsection in this report on Customer/Worker Reactions).

The shelter configuration contributed to productivity by reducing distances cooks had to travel to do their work, by providing for easy access to supplies, and by making cleaning up less of a burden. Foodservice personnel performed their own KP at the Kim Hae test.

Required sanitation labor was minimized by the use of disposable compartmented trays and plastic utensils and the use of tray packs served at the T-ration supper (since the latter

provided its own disposable preparation and serving container). Sanitation, in particular pot and pan washing and plastic tray sanitizing, required substantial labor in other field feeding systems.

By contrast, increased manpower was required to implement and administer an experimental cashless meal headcount accounting system designed by the Air Force Engineering and Services Center. The system required home base finance offices to make post-exercise payroll deductions for meals consumed in the field. The manpower expended to test this system accounted for 12.4% of all productive hours recorded for foodservice personnel and reflected a 100% increase in meal accounting labor as recorded at four previous field exercises. An unexpected side effect of the system test was a reduction in meal attendance. A substantial number of troops feared that the finance offices would miscalculate paychecks; consequently, at least 50 troops boycotted the dining hall after the "cashless" system was in place.

Further, two Air Force Commissary System (AFCOMS) personnel and a non-foodservice ration truck driver were assigned to the foodservice facility at Kim Hae. The assignment of AFCOMS personnel to field exercises was a "first", and work study data indicate clearly that they were a negative factor regarding system productivity as they were underutilized and only marginally productive. During the 72 hour work sampling study, these three non-foodservice people were recorded as on duty, either in a productive or non-productive mode, a total of 66.7 hours. Had they been available for duty 12 hours each of the three days of the work study, they would have been recorded for a total of 108 hours. Thus, their underutilization, even if they had been busy while on duty, is apparent. Further, the 50 hours of productive time recorded for the three in question was spent on inordinately long ration runs of 8 to 12 hours each to a supply depot some 30 minutes from the exercise site. This "productive" time was, therefore, of low marginal value to the foodservice operation and had a deleterious effect on measurements of system efficiency. The NLABS opinion is that the foodservice storekeeper on-site at Kim Hae could have readily performed the ration order, delivery, and inventory functions.

As pointed out above, where system design characteristics were adhered to in the Kim Hae operation, productivity was high; where these factors were compromised, productivity was diluted. Counterproductive variables notwithstanding, the New Harvest Eagle did achieve substantial manpower savings, and had meal attendance approximated the expected 70% level, the productivity level would have risen dramatically. Special services such as regular, frequent bus transportation from the exercise site to Pusan City, the ever present Mobile BX Canteen, together with troop apprehension relative to the experimental meal headcount accounting system resulted in one of the lowest meal attendance rates observed at five field exercises. The low meal attendance rate precluded validation of previous productivity estimates, but, nevertheless, significant manpower reductions were demonstrated *vis a vis* manning levels at similar feeding operations.

CUSTOMER AND FOODSERVICE WORKER OPINION AND HUMAN FACTORS

In the full fielding of the New Harvest Eagle Field Feeding System at Kim Hae, Korea in February–March 1981, Behavioral Sciences Division, Science & Advanced Technology

Laboratory, NLABS collected customer acceptability data concerning the food and the foodservice system as well as data concerning foodservice worker opinion of the system, particularly the kitchen.

Method

Customer Opinion. Customer opinion of several characteristics of the New Harvest Eagle was obtained by administering one-page paper and pencil surveys to 169 customers at their tables in the dining area who had just finished or were about to finish eating. Each member of the sample was asked individually to assist by completing a survey and leaving it on the table.

Customer Food Acceptance. Customer food acceptance data were collected using two procedures. First, in a method identical to that used on many previous field exercises, food acceptance interviewing was carried out by Behavioral Sciences Division personnel on a one-to-one basis in the dining tent with customers who had just finished or were about to finish eating. Each customer interviewed was shown a plastic laminated card containing the nine-point hedonic scale traditionally used in food acceptance and asked to rate each component of the meal as well as the meal overall. Four mid-day meals where A rations were served and four evening meals composed of tray pack items were selected for food acceptance interviewing during the peak strength build-up of the Team Spirit exercise. At each meal chosen, 30 customers were interviewed.

Since no food acceptance data existed for long-term exposure to tray packs it was decided to attempt to collect same. At the Team Spirit exercise the engineers (Prime Beef) and some members of the deployment arrived several weeks early in order to set up the physical facility and to organize the exercise itself. Approximately 35 of these personnel agreed to help in a long-range evaluation of food acceptability by giving an overall meal rating to both the mid-day (A ration) and evening meals (tray pack) every third or fourth day for the duration of the exercise. In order to differentiate this rating from the previously described procedure, and to hopefully provide some incentive to participate, ratings were conducted by handing a poker chip to each rater at the end of the meal. Each rater then "voted" by depositing his poker chip in one of nine slots in voting boxes placed at the exits from the dining tent. The nine slots were labelled verbally with the nine labels from the traditional hedonic scale and with nine smiling/frowning faces from the faces scale.*

Foodservice Worker Opinion. Twenty-four foodservice workers completed a paper and pencil survey dealing mostly with the kitchen complex. Interviews starting with general, open-ended questions concerning the good and bad aspects of the foodservice system and progressing to specific questions about pieces of equipment and the tray packs were administered on a one-to-one basis to the same 24 cooks.

*T. Kunin, The Construction of a New Type of Attitude Measure, Personnel Psychology, 1955, 8, 65–79.

Results and Discussion

Customer Opinion. Customer opinion of the New Harvest Eagle as implemented in Korea was favorable. Table 4 shows the mean ratings of eleven aspects of a foodservice system and presents data obtained from the New Harvest Eagle system in March 1981 and from a 1979 Korean exercise using the Standard Harvest Eagle foodservice system. All eleven aspects of the New Harvest Eagle food system were rated on the positive side of neutral. Five characteristics were given higher ratings by the New Harvest Eagle customers than the Standard Harvest Eagle customers – hours of operation, speed of service on lines, cleanliness, general dining facility environment, and military atmosphere. The other six characteristics were essentially rated the same by the two sets of customers. The food related variables of quantity and quality were rated favorably by the New Harvest Eagle customers as was food variety, although the latter factor was rated the lowest of the three.

Particularly relevant are the favorable ratings given the general dining facility environment by the New Harvest Eagle customers. The survey results were supported by many unsolicited favorable comments generated by customers about the dining tent during food acceptance interviewing. The only complaint recorded by the customer survey relative to the dining facility was that customers felt crowded.

Customer Food Acceptance. The generally positive ratings given the food related variables by the New Harvest Eagle customers in the opinion survey (Table 4) were reflected in the customer food acceptance ratings. As the data shown in Table 5 demonstrate, on the average New Harvest Eagle customers rated A ration items, except for starches, higher than did the 1979 Standard Harvest Eagle customers. Further, tray packs, while rated a bit lower than the A ration, were clearly judged to be acceptable, all being evaluated on the positive side of neutral(5).

Table 6 further highlights the tray pack ratings given by the New Harvest Eagle customers. Of eight tray pack entrees, only Beef Ravioli and Barbeque Beef received a mean rating below 7.00 (like moderately) on the nine-point hedonic scale. Tray pack starch ratings were lower with two of the three being rated slightly below 6.00 (like slightly). All three vegetables were rated above 7.00. One tray pack dessert, peaches (6.74), was rated below 7.00. Of a total of 281 New Harvest Eagle customers interviewed, 31 (11%) reported they had drunk the reconstituted milk; these 31 customers gave it a mean acceptance rating of 5.13.

Table 7 presents the mean food acceptance ratings given A ration and tray pack meals overall by Prime Beef members and others who had agreed to provide ratings over the course of the exercise. These personnel were all on separate rations and a cashless sign-in procedure adopted when the manpower began to increase at the exercise led several of this sample to choose to eat elsewhere, thereby limiting the "long term" data to approximately three weeks instead of the planned six or seven weeks.

Nevertheless, the data are instructive. First, in comparing these data to those in Table 5 it can be seen that although the Engineers and others were a bit more critical about the food than the general customers, their ratings were also quite high. Second, the relative ratings

Table 4

Mean Customer Ratings of Eleven Aspects of Air Force Field Foodservice

	Standard Harvest Eagle Korea 1979 (n=97)	New Harvest Eagle Korea 1981 (n=169)
a. Service by dining facility personnel	6.04	6.06
b. Chance to sit with friends	6.11	5.92
c. Hours of operation	4.77	5.62
d. Quantity of food	5.49	5.59
e. Quality of food	5.48	5.50
f. Speed of service on lines	4.16	5.49
g. Cleanliness	4.72	5.46
h. General environment	4.36	5.35
i. Military atmosphere	4.32	5.25
j. Variety of food	4.96	4.83
k. Monotony of same facility	4.30	4.37

Scale: 1 – Very bad; 2 – Moderately bad; 3 – Slightly bad; 4 – Neither bad nor good; 5 – Slightly good; 6 – Moderately good; 7 – Very good.

Table 5

Mean Customer Food Acceptance Ratings

	Standard Harvest Eagle	New Harvest Eagle	
	Korea 1979 A Ration (n=95)	Korea 1981 A Ration (n=121)	Korea 1981 Tray Packs (n=120)
Entrees	7.36	7.45	7.08
Starches	6.59	6.21	6.05
Vegetables	6.91	7.18	7.15
Desserts	7.17	8.05	7.30
Overall	7.29	7.45	7.06

Scale: 9 – Like extremely; 8 – Like very much; 7 – Like moderately; 6 – Like slightly; 5 – Neither like nor dislike; 4 – Dislike slightly; 3 – Dislike moderately; 2 – Dislike very much; 1 – Dislike extremely.

Table 6

Mean Customer Food Acceptance Ratings of Tray Pack Items at Team Spirit '81, Korea

Item	N	Mean
Entrees		
Chicken Breasts	19	7.79
Sloppy Joe	16	7.44
Salisbury Steak	18	7.22
Beef Bourgignon	14	7.21
Chicken Cacciatore	12	7.17
Lasagna	11	7.09
Beef Ravioli	11	6.45
Barbeque Beef	20	6.25
Starches		
Scalloped Potatoes with Ham	23	6.87
German Potato Salad	22	5.91
Stew Cut Potatoes	45	5.87
Vegetables		
Lima Beans	7	7.43
Corn	76	7.16
Green Beans	37	7.03
Desserts		
Cherry Nut Cake	11	7.91
Apple Dessert	29	7.66
Cherry Dessert	17	7.24
Peach Dessert	23	6.74

Scale: 9 – Like extremely; 8 – Like very much; 7 – Like moderately; 6 – Like slightly; 5 – Neither like nor dislike; 4 – Dislike slightly; 3 – Dislike moderately; 2 – Dislike very much; 1 – Dislike extremely.

Table 7

Mean Ratings of Prime Beef and Early Arrivals Overall Meal Food Acceptance Data

Date	N	A Ration	Tray Packs
18 February	38	7.63	7.04
20 February	35	7.28	6.90
23 February	37	7.50	6.67
27 February	36	6.85	6.65
3 March	34	7.45	6.33
6 March	30	6.62	6.92
9 March	31	6.62	7.25
Overall Mean		7.11	6.82

Scale: 9 – Like extremely; 8 – Like very much; 7 – Like moderately; 6 – Like slightly; 5 – Neither like nor dislike; 4 – Dislike slightly; 3 – Dislike moderately; 2 – Dislike very much; 1 – Dislike extremely.

of A ration and tray pack meals were about the same. Third, there is no evidence for either A ration or tray packs that acceptability deteriorated over time, at least not over the three weeks duration of this test.

Foodservice Worker Opinion. The 24 cooks surveyed/interviewed in the 1981 Korea test of the New Harvest Eagle were distributed grade-wise with 50% being E–3's, 33% being E–4's, and the remaining 17% being two E–5's, one E–6, and one E–7. These cooks were not, however, field experienced; half of them had no prior field experience at all. Another 29% had only been in the field once previously (including the foodservice superintendent) and another 8% had been in the field twice. Only 13%, then, had been on three or more field exercises. On almost every variable rated or commented on by the cooks, those with prior field experience were more positive about the New Harvest Eagle than those with no field experience.

In the survey, cooks were asked to rate fourteen aspects of their field kitchen on a seven point scale. Table 8 shows the mean ratings for the 1981 Korea New Harvest Eagle cooks, the 1979 Korea Standard Harvest Eagle cooks, and a composite of cook ratings from all three Standard Harvest Eagle exercises including the 1979 Korean one. As can be seen, on each of the fourteen characteristics, New Harvest Eagle cooks gave higher mean ratings than the cooks on the 1979 Korea exercise and higher than the cooks on the composite of all three Standard Harvest Eagle exercises. Further, the New Harvest Eagle mean ratings were often more than one scale point higher. The biggest differences between cooks' perceptions of the New and Standard Harvest Eagle were in the areas of lighting, condition of equipment, speed of service, ease of serving the customer, size of the kitchen, ease of access to supplies, amount of storage space, and the crowding of cooks.

The only rating on the negative side of the neutral point concerned the temperature, but even that rating was higher than the rating given by the Standard Harvest Eagle cooks.

The workspace aspect of the kitchen was followed up with a more detailed question, the answers to which are summarized in Table 9. In the Standard Harvest Eagle, the average rating of kitchen size was 2.26 on a seven point scale (between "somewhat too little" and "slightly too little" workspace). The New Harvest Eagle cooks were less critical of the workspace, giving it a mean rating of 3.17 (between "slightly too little" and "just about right)." Nevertheless, their response would seem to indicate the perception of a need for more space by the cooks. This conclusion should be tempered by two things. First, the fact that field experienced cooks rated the kitchen workspace nearer to "just about right" than cooks with a lack of field experience. Second, many of the New Harvest Eagle cooks claimed there were too many cooks in the kitchen, an observation corroborated in the productivity evaluation in this previous section. Perhaps "extra" cooks cut down on the available workspace.

Overall, cooks who had worked in other field kitchens rated the New Harvest Eagle as being "somewhat better" (6.02 on a seven point scale) than other field kitchens in which they had worked.

The foodservice worker interviews began with general open-ended questions concerning the good and bad aspects of the New Harvest Eagle foodservice system. The good aspects most frequently mentioned by five or more cooks were the equipment (by 75% of the cooks),

Table 8

Comparative Foodservice Worker Ratings of the Standard and the New Harvest Eagle

	Standard Harvest Eagle Korea 1979 (n=13)	3 Standard Harvest Eagle Exercises (n=59)	New Harvest Eagle Korea 1981 (n=24)
a. Lighting	4.15	3.76	5.50
b. Ease of food preparation	4.77	5.04	5.46
c. Condition of equipment	4.08	4.52	5.42
d. Speed of service	3.54	4.11	5.29
e. Ease of serving customer	3.83	4.20	5.17
f. Size of kitchen	3.67	3.18	4.92
g. Ease of access to supplies	3.77	4.04	4.88
h. Ease of cleaning up	4.00	4.38	4.79
i. Noise	4.38	3.99	4.75
j. Ease of setting up kitchen	4.23	3.72	4.73
k. Ease of moving with kitchen	4.07	3.53	4.61
l. Amount of storage space	2.69	3.59	4.46
m. Crowding of cooks	3.00	3.06	4.33
n. Temperature	2.92	2.37	3.75
Overall		4.20	5.42

Scale: 7 – Very good; 6 – Moderately good; 5 – Slightly good; 4 – Neither good nor bad; 3 – Slightly bad; 2 – Moderately bad; 1 – Very bad.

Table 9

Foodservice Worker Ratings of Kitchen Workspace

	Much Too Little 1	Somewhat Too Little 2	Slightly Too Little 3	Just Right 4	Much Too Much 7
3 Standard Harvest Eagle Exercises (n = 59)	XXXXXXXXXXXXX (2.26)				
New Harvest Eagle All Cooks (n = 24)	XXXXXXXXXXXXXXXXXXXXXXX (3.17)				
New Harvest Eagle No Field Experience (n = 12)	XXXXXXXXXXXXXXXXXX (2.76)				
New Harvest Eagle Field Experience (n = 12)	XXXXXXXXXXXXXXXXXXXXXXXXXXX (3.58)				

workspace in the kitchen (38%), the tilt grill (33%), the kitchen tent itself (33%), the connective vestibules between tents (25%), the burner system (25%), and the potato extruder (21%).

The most frequently mentioned bad aspects of the system (again by five or more cooks) were the ovens (46%), frozen water lines (29%), lighting the burners (25%), the faulty burner safety valves (21%), and tray packs being difficult to open (21%).

Specific interview questions were then asked addressing specific aspects of the New Harvest Eagle system.

Ease of Operation. Ninety-two percent of the cooks felt that the equipment was easy to operate. The two cooks (8%) who disagreed complained about the lighting of the burners.

Serving Line. Just over half the cooks (58%) felt that the serving line was adequate as it was. The ten cooks who made up the other 42% felt that one (9) or two (1) slots should be added to the line.

Burner System. As should have been evident from the open-ended questions on good and bad aspects of the system where 25% volunteered the burner system as a good aspect and another 25% as a bad aspect, there was some disagreement about the burners on the part of the cooks. Most complaints about the burners centered around the lighting of the burners, the leaking torches used to light the burners, and the faulty safety valve. When asked if the burner system was adequate, 88% of the cooks said "yes".

Further, when those cooks who had previously used M–2A burners were asked which system was better, 76% said the New Harvest Eagle system was better, 12% said the M–2A was better, and the remaining 12% said they were about the same. When asked why the New Harvest Eagle burner system was better, the most frequent reasons cited by the cooks were that it was safer to have the fuel supply located outside the kitchen, it was easier to not have to refill the burners repeatedly, and the burners were easier to light.

It should be noted, however, that some cooks, even some of those who preferred the new burners, did have complaints about lighting the burners with torches.

Temperature. Over half the cooks (52%) were concerned with the temperature in the kitchen.

Safety Hazards. The most frequent responses to a question concerning safety hazards were slippery floors in the kitchen (46%), the blow torches (29%) and lighting the burners (29%).

Deep Fat Fryer. When asked if the deep fat fryer was adequate, 88% of the cooks said yes. Five cooks (21%) felt that it should be bigger.

Potato Extruder. Eighty-three percent of the cooks felt the potato extruder was adequate.

Dining Shelter. The cooks were unanimous in saying that the dining tent was a good idea.

Sanitation Center. Only one cook (4%) complained about the sanitation center. The other 96% felt that it was good.

Tray Packs. The cooks were asked whether they thought serving one tray pack meal a day in the field was a good idea or a bad idea. Only one cook (4%) was against the idea, while 83% supported it as a good idea. Another 13% had some doubts, but were not prepared to say it was a bad notion. Some cooks (25%) thought two tray pack meals should be served a day.

Some concerns were raised about tray packs by cooks. Specifically, some felt that they were hard to open and some thought they were too small.

Human Factors. The size of the New Harvest Eagle Kitchen and workspace layout were far superior to any kitchen previously observed in the field. The major human factors concern with the kitchen stemmed from the lighting of the burners. The new burner system as employed during the exercise seems to be safer than the M--2A system for a variety of reasons.

Two other human factors areas should be addressed. As mentioned by some of the cooks, the kitchen flooring was slippery when wet. In addition, there were several instances where cords and fuel lines posed potential trip hazards.

The sanitation center provides a significant advantage over pot and pan washing facilities, or the lack thereof, in the Standard Harvest Eagle. The pot and pan sinks in the sanitation center were designed according to human factors standards. While the height of the pot and pan sinks may be too high for very short cooks, any adjustment of the height would cause problems for average or taller cooks. The short cook should perhaps be accommodated with some type of box or stool on which to stand.

SYSTEM ELEMENT EVALUATIONS

From the outset of this study of Air Force field feeding, a systems analysis strategy was employed. Subsystems of the foodservice system were identified, and each was studied both separately and in concert with the total system. During the 35-day field evaluation in Korea, data were collected and later analyzed. These data make possible an empirically based appraisal of each subsystem including recommendations for improvements. This section reports on the effectiveness of the subsystems; a subsequent section summarizes recommended refinements to these subsystems.

The Manning Standard

The sole Air Force manning standard for foodservice personnel in the field is the Unit Type Code (UTC) which applies to wartime operations only. Foodservice manning at field exercises is based on traditional practice rather than empirically derived manning standards.

An NLABS recommendation is to adopt a formula for determining foodservice manning which is factored to accommodate relevant variables in both exercise and contingency situations.

Relevant variables considered in the NLABS formula include the number of authorized meals to be served, the total number of troops in the deployment, the estimated meal attendance rate, the productivity of the foodservice system in meals per manhour, and the average length of the workday which is derived from Air Force policy on workload, i.e., 12-hour shifts and a six-day work week. The formula can be adapted to varying known conditions simply by inserting the appropriate numbers for the variables. The application of the formula proceeds in these steps:

1. Calculation of workload in meals: No. Daily Authorized Meals x Deployment Size x % Meal Attendance = No. Daily Required Meals.

2. Conversion of workload in meals to workload in manhours:

$$\frac{\text{No. Daily Meals}}{\text{System Productivity in No. Meals Per Manhour}} = \text{No. Daily Manhours Required}$$

3. Conversion of workload into number of required workers:

$$\frac{\text{No. Daily Manhours}}{\text{Average Hrs Per Day Per Worker}} = \text{No. Foodservice Workers}$$

where average hours per day per worker = shift length in hours x no. of work days per week ÷ 7.

Illustrations of applications of the formula to serveral deployment situations are listed below:

1. Manning projections for a deployment of 1026 (the projected Kim Hae size) during wartime feeding operations.

Authorized Meals (3) x Deployment Size (1026) x % Meal Attendance

(90%) = Number of Daily Required Meals (2770).

$$\frac{\text{No. of Daily Required Meals (2770)}}{\text{No. Meals Per Manhour (12)}} = \text{No. Daily Manhours (231)}$$

$$\frac{\text{No. of Daily Manhours (231)}}{\text{Average Daily Hours Per Worker (10.3)}} = \text{No. Required Foodservice Workers (23)}$$

2. Where Average Daily Hours Per Worker (10.3) = Shift Length (12 Hrs) x Work Days (6) ÷ 7.

Manning projections for the Kim Hae deployment during exercises where a 50% meal attendance rate is anticipated would be:

$$3 \times 1026 \times 0.50 = 1539 \text{ Daily Meals}$$

$$\frac{1539}{12} = 128 \text{ Daily Manhours}$$

$$\frac{128}{10.3} = 13 \text{ Foodservice Workers}$$

The NLABS manning formula was applied to the Kim Hae site during Team Spirit '81. A deployment of 1026 was anticipated and a meal attendance rate of 70% was forecast. The formula projected 17 workers would be sufficient to operate the New Harvest Eagle. However, NLABS requested an additional eight workers as reserves in the event of unexpected contingencies.

As discussed in an earlier section on System Productivity, the low meal attendance rate and several other conditions imposed upon the system precluded a reliable validation of the meal production capacity forecast. For similar reasons, the manning standard proposed for the New Harvest Eagle could not be validated. The management insisted on using all available personnel including supernumeraries. Therefore, there were too many cooks on each shift; cooks worked shorter than 12-hour shifts; shifts overlapped longer than the design plan provided by NLABS (Appendix I); and there was, in general, underutilization of the work force, e.g., cooks 36% non-productive during the supper meal; a supervisor recorded as 75% unoccupied during the same period; and the AFCOM people recorded as non-productive 73% of the time.

In short, NLABS prescribed conditions, those considered prerequisites to work force efficiency and consequently to the validation of the manning standard, did not obtain at Kim Hae. These deficiencies were intrinsically counterproductive. Their effect was compounded by the unanticipated very low meal attendance rate. Therefore, the NLABS New Harvest Eagle system manning standard still remains as an estimate projected to provide an adequate work force while effecting substantial savings in manpower. The data collected at Team Spirit '81, as discussed in the section on System Productivity, imply the validity of this assumption, but it is recommended that a controlled system productivity test be undertaken to accurately assess the maximum efficiency of the New Harvest Eagle.

The Shelter System (including heating/lighting).

The TEMPER shelter system was deployed to Team Spirit '81 and configured in the same manner as at the Eglin AFB feasibility test. The overview displayed in Figure 1 depicts the three major components of the system: an 11-section dining shelter, a 5-section kitchen, and an 8-section sanitation/storage shelter. Connecting vestibule sections provide protection to patrons in queue and offer weather, dust, and insect protection to workers and diners. As discussed earlier in this report, the prototype shelter is designed to support an 1100 troop deployment in the climatic zones between the Arctic and Anarctic Circles.

Figure 1. The New Harvest Eagle Shelter System

The layout and erection of the TEMPER were accomplished without difficulty. Both the Prime Beef engineers and foodservice personnel participated in the shelter erection. A videotape of the shelter being erected at Eglin AFB was shown to the troops prior to the Kim Hae erection. An operational manual was also provided. Both the manual and the videotape were used to advantage by the workers.

Prime Beef engineers, none of whom had experience with the TEMPER, laid the plywood floors and put up the kitchen shelter and the sanitation/storage shelter. Elapsed time to erect both shelters (not including floor construction) was one hour and 40 minutes. Erection of the dining shelter was accomplished by the foodservice group under the direction of an AFESC senior NCO who had prior experience with the shelter system at Eglin AFB and an NLABS shelter expert. As planned, the dining shelter erection was used as a training experience for cooks and their evaluation of the training indicates it was a successful effort.

Design characteristics of the TEMPER generally proved highly acceptable. Several minor refinements are suggested. When there is customer traffic through the main entrance to the dining hall, and in fact, wherever moderate to heavy traffic is expected, the door flaps must be rolled up to prevent excessive use of door zippers, which malfunction if heavily used. The flaps serve a useful function by sealing off areas, but they should not be used as doors. Also, door screens cannot be closed from the outside, a characteristic which limits their usefulness to simply provide ventilation.

Aluminum bump through doors were added to the shelter system after the Eglin test. A bump through vestibule door was located in the vestibule at the customer entrance to the dining hall and one was positioned at a customer exit. The doors were fitted with plexiglass

and were found to be extremely effective in protecting the dining area. It is recommended that bump through doors be placed at all entrances and exits in all three shelter areas. Inserts should be made so that screening can be substituted for plexiglass when desired.

Two vestibule frames broke at welded joints during the exercise; however, it would appear the breaks were from poor workmanship rather than faulty design.

A plywood dining shelter floor was fabricated and installed. A dining shelter floor is not recommended for rapid deployment though one should be installed if the system is to remain in place beyond 60 days.

The cooks and customers commented that the configuration of the several shelter components was most appropriate. The connecting vestibules made possible a completely sheltered and integrated system in which functional areas are separated for efficiency and attractiveness, yet connected for easy access and convenience.

The kitchen shelter and workspace were considered adequate. When asked if the dining tent was adequate, 100% of the cooks responded in the affirmative. In addition, it was observed that patrons never had to wait for table space and chairs. Even when more than 400 diners ate during a given meal period, there was always ample seating for customers. Dining shelter adequacy at Kim Hae was a fortuitous finding in view of the design criterion size of the New Harvest Eagle. There is now no doubt that the dining facility can accommodate in excess of 300 patrons hourly, and more than 1000 patrons during a normal major meal period.

The floor covering in the kitchen and sanitation/storage shelters was a fire retardant vinyl. One piece was fabricated to cover the kitchen floor and another piece to cover the sanitation/storage floor. The single piece per floor (versus the Velcro jointed sections used at the Eglin test) proved highly acceptable, and is recommended for future systems. A gasoline fire on the kitchen floor melted the vinyl covering, but the covering did not burn. No floor covering was used in the dining shelter, and none is recommended.

The tent fabric proved to be weak and porous. When a heavy rain came to Kim Hae, the dining shelter leaked badly. After the roof fly was installed, the dining shelter stopped leaking. The kitchen and sanitation/storage shelters had roof flys from the beginning and did not leak. Causes of the faulty fabric have been identified and are being corrected. However, it is recommended that roof flys be installed over all shelter components as a precaution against unexpected leakage. Fabric in the vestibule shelter was perforated during shipping to Korea. The cause is believed to be improper packing for shipping as frames were packed in the same bundle. Some water seepage was observed where pieces of the fabric were jointed by thread to other fabric and to plastic window sections. This may have been due to the use of an improper thread.

An evaluation of the two materials tested as part of the white kitchen liner showed the vinyl coated material to be superior to the cotton duck cloth. The liner, in general, held up well except for scorching directly over the griddle heat stack. Cooks and other observers commented on the attractive appearance of the kitchen due in large part to the liner effect. The vinyl coated liner is recommended for the kitchen liner. The liner screening should be repositioned to better accommodate the griddle heat exhaust.

Lighting was rated very high by customers and workers. The lights in the dining shelter were fluorescent with white rectangular reflector shields. Lighting in the kitchen was provided by the Bruce fluorescent illumination system* first used in the field kitchen at the Eglin test (see Figure 2). The problem of overheating observed at Eglin, was partially corrected by the Bruce Company. It is anticipated that with repositioned vents in the kitchen liner, the Bruce lights, as modified for Team Spirit '81, will be acceptable. The sanitation/storage area was also lighted by Bruce lights, and no overheating problems were observed there. Bruce lights are recommended for lighting in the kitchen, dining, and sanitation/storage areas.

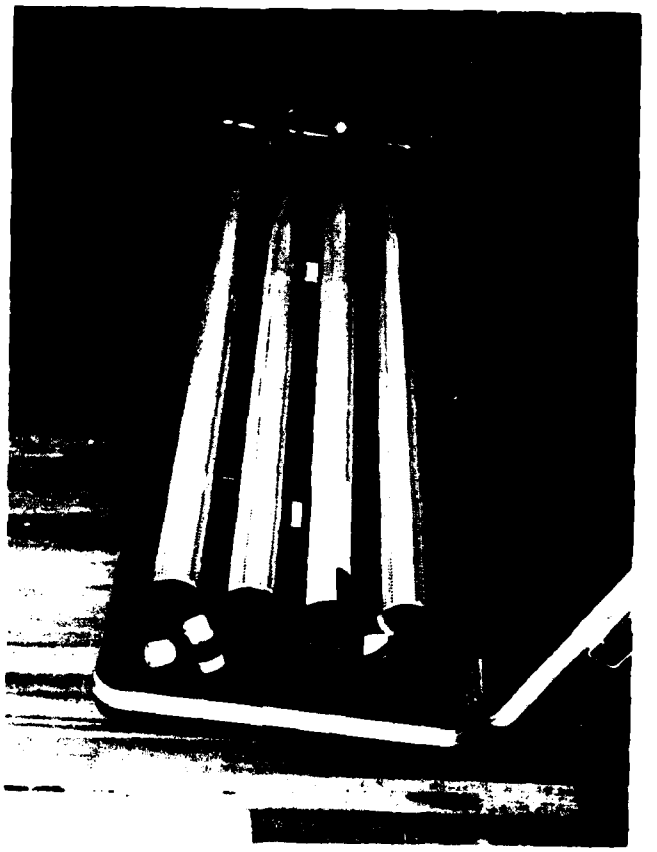

Figure 2. Bruce Lights

The dining shelter and, on very cold days, the storage area, were heated by two 400,000 Btu gasoline fired air heaters** (see Figure 3). These heaters were more than adequate to heat the dining shelter when ambient temperatures were in the low teens. One heater was adequate to heat the shelter when the ambient temperature was no lower than 30°F. However, the heaters were unreliable and failed repeatedly. Carburetor icing was a constant problem. Numerous other problems plagued the heaters. One heater "blew" a fuel pump seal and had to be removed permanently. The problem heaters are being analyzed by the US Army Mobility Equipment R&D Command, which has responsibility for these heaters. The heaters are simple

*See Item 39, Table 11 in the Equipment Section.

**See Item 48, Table 11 in the Equipment Section.

Figure 3. Portable Air Heater

to operate and permit varied heat distribution. When they work properly they are highly effective. It is recommended that, pending reports on the causes of the malfunctions at Kim Hae, the decision to adopt this particular type heater be held in abeyance. Should the heater problems prove solvable, it will be recommended that two heaters accompany each basic unit of the New Harvest Eagle.

In summary, the TEMPER provided an adequate shelter system for the New Harvest Eagle at its field evaluation in Korea. The configuration and attractiveness of the system were appreciated by workers and customers. The dining and work spaces were found to be sufficient to meet design criteria. The lighting and heating systems were adequate; however, each system experienced problems which are currently being resolved. The shelter fabric is being replaced by an improved fabric.

It was learned at Team Spirit '81 that foodservice people could, with minimum training time, erect, assemble, and strike their shelter system. Self-sufficiency for the foodservice group was a goal of major importance in the project. The TEMPER contributed to manpower savings through its design and operational characteristics which made all food system tasks less time consuming to accomplish.

The Equipment System

In addition to considerations of capacity and reliability, equipment selection criteria for the New Harvest Eagle included: (1) the capability to offer the varied Air Force Field Feeding Menu; (2) a minimum labor requirement; (3) a dual fuel capability, i.e., gasoline and electric power; and (4) maximum cost savings. The above requirements were met by utilizing selected items from the existing inventory of Harvest Eagle equipment; by fabricating and modifying equipment at NLABS; and by purchasing commercial items known to be reliable and adaptable to field conditions.

At the Eglin AFB Prime Beef training site, all system equipment was tested for feasibility and operability and was found satisfactory. Equipment evaluation at the Korean exercise emphasized production capacity, reliability, and labor requirements. When asked what they liked about the New Harvest Eagle, 75% of the cooks at Kim Hae said, "The equipment (with the exception of the ovens) was excellent." Equipment received the highest rating compared with all other aspects of the system. As for production, the equipment easily met the daily meal requirement (without the nonoperative ovens), however, the system fed fewer meals than its design capacity due to low customer attendance.* It was further demonstrated that the system can offer the official Air Force Field Feeding Menu whether the evening meal consists of T-rations or A-rations.**

The manpower requirement to operate the New Harvest Eagle equipment is discussed in the System Productivity section of this report. As was observed in that section, the field kitchen was overstaffed and underutilized at Kim Hae.

All equipment, except the field ovens, functioned reliably during the 35 days of operation at Kim Hae. No corrective maintenance was performed on any food related equipment (not including the burner safety valve). The field ovens did not reach cooking temperature and were used only as warming cabinets. It was learned during post-exercise testing and analysis that the problem in achieving oven temperature was caused by faulty burner generators.

Redundancies built into the equipment system proved workable and valuable. For example, when the fuel-fired ovens failed to reach cooking temperature, use of the electric tilt grill was increased. Also, when the electric power failed briefly, the fuel fired burners provided adequate hot water to heat the T-rations. Thus, the system proved to be a practical two-fuel system in that it prepared required meals with either gasoline or electric power. In this regard, kitchen operations are greatly enhanced, since food heating and holding functions can be readily performed by either heat source.

An artist's sketch of the NHE system indicating the shelter configuration and equipment location is presented in Figure 4. The listing and location of the specific equipment as deployed in the Korean field test are included in Table 10 and Figure 5. In Table 11, equipment items and pertinent technical and other data are documented. These data are essential to system

*The design capacity of the New Harvest Eagle prototype was derived as follows: A (1100) troop deployment x (3) authorized daily meals per troop x (90%) customer meal attendance rate = a (2970) daily meal requirement.

**The experimental menu planned for Team Spirit included a daily T-ration supper. However, due to a large oversupply of perishable A-ration items, the T-ration meals were replaced by A-ration meals during the last week of the exercise.

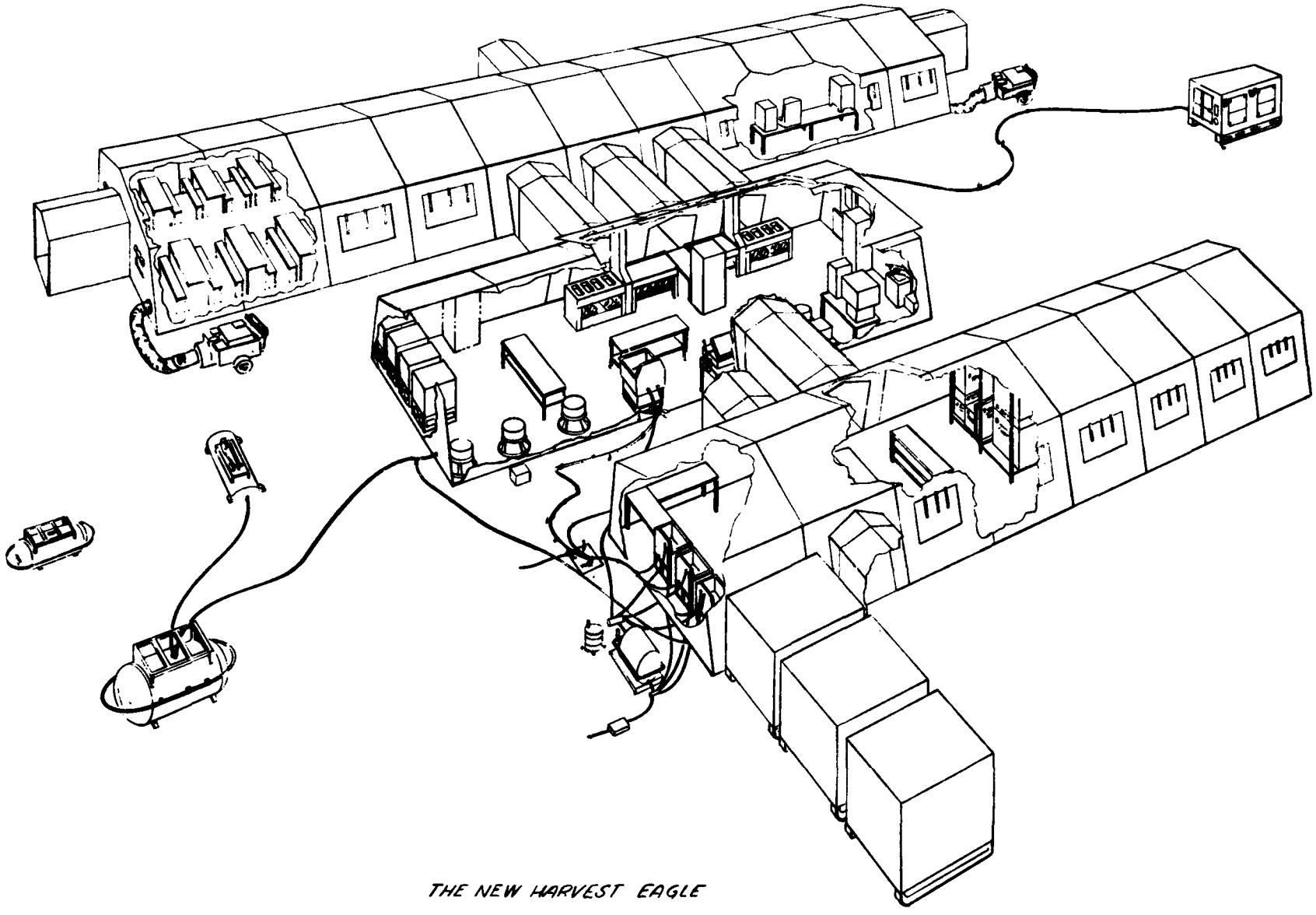

Figure 4. The New Harvest Eagle Shelter Configuration and Equipment Location at the Korean Field Test

Table 10

List of Equipment by Functions

Food Preparation Equipment

1. Tilting, Frying and Braising Pan (9" Deep)
2. Fryer, Deep-Fat
3. Ventilator, Proximity
4. Filter, Grease
5. Potato, Extruder, Automatic
6. Potato, Extruder, Manual
7. Griddle Assembly
8. Cook-Pot Assembly
9. Oven, Field, Assembly
10. Coffee Dispenser
11. Coffee Brewer, Automatic, 5-Pot
12. Coffee Brewer, Automatic, 2-Pot
13. Vegetable Slicer
14. Meat Slicer
15. Can Opener "T" Ration
16. "T" Ration Safety Lifter
17. Sink, Vegetable Preparation
18. Ice Machine
19. Toaster, Conveyor, Electric
20. Table, Food Preparation

Food Service Equipment

21. Warming Cabinet
22. Steam Table Assembly
23. Beverage Dispenser (2)
24. Milk Dispenser

Sanitation Equipment

25. Sanitizing Sink w/2 Drain Tables
26. Water Heater and Circulating System
27. Grease Trap Assembly
28. Storage Racks
29. Handwashing Sink

Refrigeration Equipment

30. Refrigerator, Mechanical, Portable, Walk-In
31. Refrigerator, Upright Reach-In

Dry Storage Equipment

32. Shelving Assembly

Remote Tank Burner System

33. Fuel Main Supply Tanks
34. Compressor, Air
35. Fuel Lines
36. Tankless Burner Unit

Power, Lights and Heating Equipment

37. Generator, 60KW, 30, 4 Wire
38. Control Panel, 30, 4 Wire
39. Lights, Bruce, Plus Light Bars
40. Heater, Duct Type, Portable, 400,000 BTU

41. Fuel Barrel, Diesel
42. Dining Tables

* Two Bruce Lights are Suspended from each Kitchen Section

As Deployed at Team Spirit '81
Kim Hae, Korea

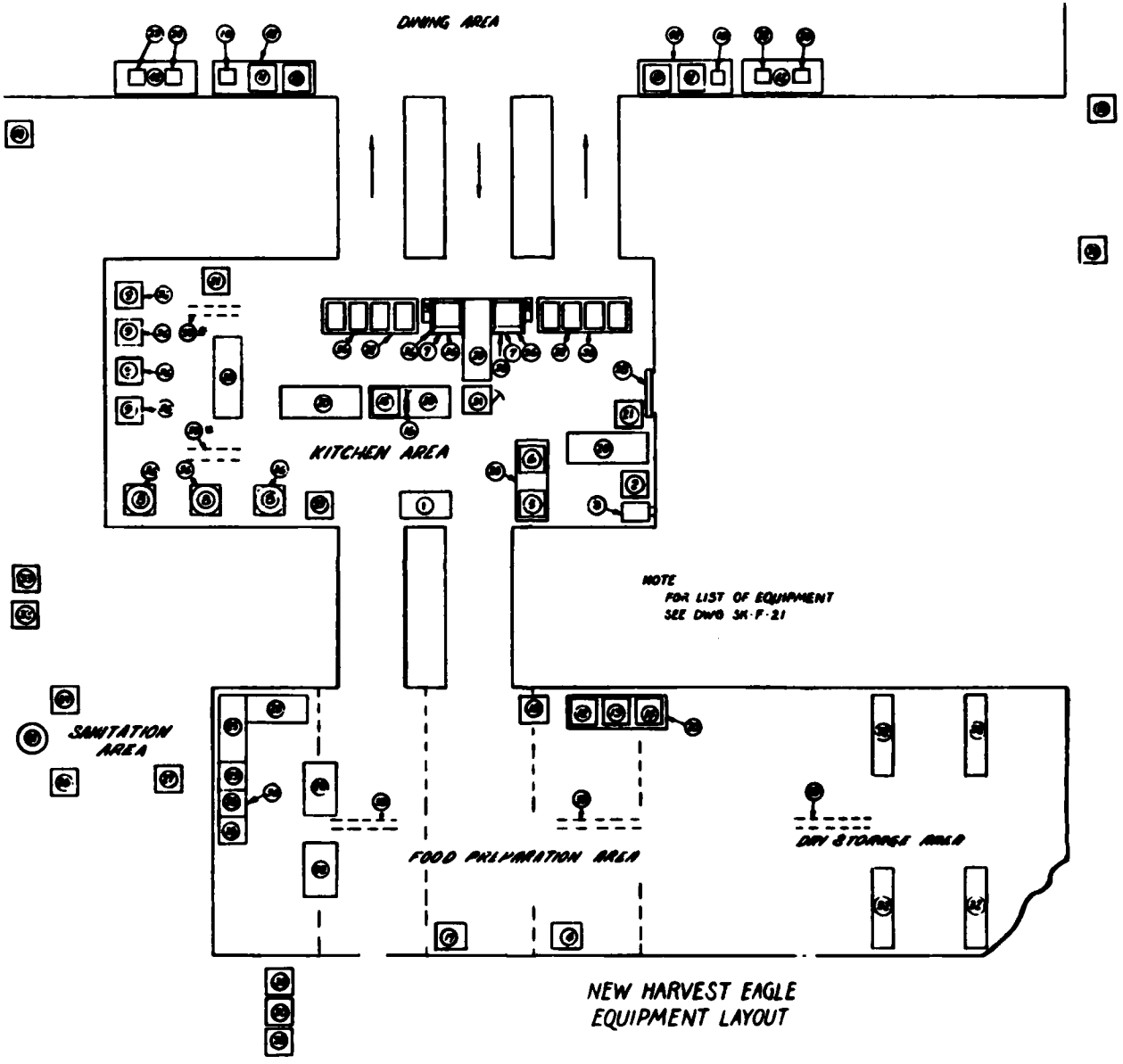

Figure 5. The New Harvest Eagle Equipment Layout

Table 11

Equipment Items and Pertinent Data for the New Harvest Eagle System as Field Tested at Team Spirit '81

Item No.	Item	Manufacturer	Model No.	Quantity Installed	Estimated Cost (ea)	NSN	Specification
A.	**Commercial Equipment**						
21	Cabinet Warming	Cresent Metal Products Inc.	H-138-CDD-1834	2	$1,000.00	–	–
15	Can Opener, T-Ration	Edlund Co., Inc.	1-R	3	60.00	–	FF-0-601-Type IV, Modified for T-ration
11	Coffee, Brewer (5-Pot)	Bunn-O-Matic Corp.	RL-35	2	425.00	7310-01-105-0427	W-C-500-Type I, Class 1, Style B, Model-S
12	Coffee, Brewer (2-Pot)	Bunn-O-Matic Corp.	OL-15	1	345.000	7310-01-104-0793	W-C-500-Type I, Class 1, Style B, Model-S
10	Coffee Dispenser	Wilbur Curtis, Inc.	MCD-7	2	60.00	–	–
4	Filter, Cooking Grease	Dean Industries	MF-90AU/80	1	600.00	–	MIL-F-2296-Type III
2	Fryer, Deep-Fat	Toastmaster Division of Bastian Blessing	1456	1	900.00	–	S-F-695-Type II, Size 4 Model L, Grade A, Style 1, Class 2
39	Lights, Luminar, Portable, Flourescent (w/case & lights)	Bruce Industries, Inc.	BR8023-601*	27	205.00 (per set)	–	
5	Potato Extruder, Automatic	American Potato Co.	550	1	3,200.00	–	MIL-S-43589-Type III Except 120 Volt
6	Potato Extruder, Manual	American Potato Co.	106B(Frispo-ette)	1	795.00	–	–
28	Rack, Storage	Metropolitan Wireware Corp.	1848C (Shelves) 1862C (Upright)	4 2	28.90 24.30	7125-00-707-3041	MIL-S-40144, Type 1, Style 1, Size 2
31	Refrigerator, Upright Reach-In	Hobart Corp.	HS-1	1	1,585.00	4110-01-009-3738	AA-R-200-Type H, Size 20, Style 1

*A modification of this model is in progress which will enable the light to operate on both 50 and 60 cycle current.

Table 11

Equipment Items and Pertinent Data for the New Harvest Eagle System as Field Tested at Team Spirit '81 (Cont'd)

Item No.	Item	Manufacturer	Model No.	Quantity Installed	Estimated Cost (ea)	NSN	Specification
32	Shelving w/shelves & Posts (adjustable)	Metropolitan Wireware Corp	S2448N & S63P	4 Units Complete	$ 120.00	–	MIL-S-40144-Type II, Style 1, Size 4, Except Leg Mounted
29	Sink, Hand	Metal Masters Food Service Equipment Co.	314-16-1	1	500.00	–	–
20	Table, Food* Preparation	–	–	–	–	7330-00-269-9231	MIL-T-2256, Type I, Grade A, Class 1, Style 1 Size 1
1	Tilting, [illegible]ing & Braising Pan (9" deep)	Groweo Division of Dover Corp.	FPC-4	1	2,200.00	7310-01-104-4385	MIL-P-23694, Type I, Class A, Style A, Size 4
16	T-ration Safety Lifter	Emerson Sack Warner Corp	X-9	3	93.00	–	–
13	Vegetable, Slicer	Qualheim, Inc	440	1	–	–	00-V-205-Type I, Style A, Class 2
3	Ventilating, Hood Proximity	Jenn Industries, Inc.	PV-300	1	1,300.00	–	–
B.	Depot Item						
40	Heater, Duct Type, Portable, 400,000 BTU		Type H-1	2	–	4520-00-915-7789	MIL-H-4607-Class 3

*Two of these tables were of the knock-down, field type (MC-7 DTD 7 Feb 77)

Table 11

Equipment Items and Pertinent Data for the New Harvest Eagle System as Field Tested at Team Spirit '81 (Cont'd)

Item No.	Item	Manufacturer	Model No.	Quantity Installed	Estimated Cost (ea)	NSN	Specification
C.	Existing Harvest Eagle Equipment						
44	Chair, Folding Metal Frame	–	–	130	–	7105-00-269-8463	–
34	Compressor, Air, Portable, Reciprocating, Single Stage	–	3/4 HP	1	–	4310-00-716-4405	–
23	Dispenser, Beverage, Insulated	Cambro MFG Co.	500 LCD	2	–	7320-01-093-7371	MIL-C-43916
24	Dispenser, Milk	Cambro MFG Co.	500 LCD	2	–	7320-01-093-7371	MIL-C-43916
37	Generator Set, Diesel Engine	–	60 KW (240 LNE) 60 KW (MEP006A)	2	–	6115-00-081-2034 6115-00-118-1243	(master)
18	Ice Machine	–	–	1	–	41100-00-837-6442	MIL-I-11867
14	Meat Slicing Machine	–	–	1	–	7320-00-222-4177	00-M-280-Type II, Class 2, Style 1, Model 1
30	Refrigerator, Mechanical Portable, Walk-in Type 150 cu. ft. capacity	–	–	3	–	4110-00-274-6342 (Note: U/W)	MIL-I-12571
42	Table, folding, Wood Top	–	72 inch	120	–	7195-00-357-7480	MIL-T-13795
43	Table, Folding, Wood Top	–	36 inch	4	–	7105-00-269-8463	MIL-T-3338
19	Toaster, Conveyor, Electric Electric	–	–	2	–	7310-00-282-9827	S-T-540-Type I, Size 2

Table 11

Equipment Items and Pertinent Data for the New Harvest Eagle System as Field Tested at Team Spirit '81 (Cont'd)

Item No.	Item	Manufacturer	Model No.	Quantity Installed	Estimated Cost (ea)	NSN	Specification
D.	NLABS Developed Equipment						
36	Burner Unit, Tankless	–	–	20	–	–	NLABS DWG No. SK-F-77
38	Control Panel	–	–	1	–	–	400 AMPS SVC, 8/208 V receptacles, 12/120 V receptacles, Main circuit breaker w/20 individual breakers
8	Cook Pot Cradle (Modified)	–	–	3	–	–	MIL-C-40077-Cook Pot Cradle (modified) used w/NSN 7330-00-234-8832 Cooking Pot (60 qt capacity) under NLABS DWG No. SK-F-386, DTD 15 Feb 80
35	Fuel Distribution Line Assembly (14 burners)	–	–	1	–	–	NLABS DWG No. SK-F-88 DTD 29 Dec 80
33	Fuel Tank Assembly	–	–	2	–	–	NLABS DWG No. SK-F-85
27	Grease Trap (w/sump pump and heater)	–	–	1	–	–	NLABS DWG No. 6-1-3854, DTD 30 Jun 72 used w/NLABS DWG No. 6-1-3853 Drain System, DTD 30 Jun 72
7	Griddle Assembly Stand Mounted, M-1975	–	–	2	–	–	Purchase description: MD-6, DTD 4 Feb 77
9	Oven, Field, Single Burner, 2-Pan Capacity	–	–	4	–	–	NLABS DWG No. SK-F-50, Not DTD
25	Sink, Sanitizing Sink, Drain Table	–	–	3 2	–	–	Limited Purchase Description - LP/P DES 4-80 DTD 30 Apr 80

Table 11

Equipment Items and Pertinent Data for the New Harvest Eagle System as Field Tested at Team Spirit '81 (Cont'd)

Item No.	Item	Manufacturer	Model No.	Quantity Installed	Estimated Cost (ea)	NSN	Specification
17	Sink, Vegetable Preparation	–	–	1	–	–	Limited Purchase Description - LP/PD254-80, DTD 30 Apr 80
22	Steam Table Assembly Stand Mounted - M-1975	–	–	2	–	–	Purchase Description: MC-6, DTD 4 Feb 77
26	Water Heater and Circulating System	–	M-80	1	–	4410-01-103-5588	Limited Purchase Description - LP/P DES 11-79, DTD 31 Jul 79

procurement. A brief illustrated discussion and performance evaluation of NHE equipment used at the Korean field test follows. Emphasis is given to equipment not previously in the Air Force Field Feeding inventory. The discussion of equipment performance is organized by functional areas: food preparation, food serving, sanitation, refrigeration, and dry storage. A discussion of the remote tank burner system is included in the Equipment Section. Fuel, water, and electric consumption are discussed in the Utility Requirement Section.

Food Preparation Equipment

Tilting, Frying, and Braising Pan (Item 1)*:

Description. The tilting, frying, and braising pan (Figure 6) is designed for all types of pan frying and braising, for preparing sauces and stews, and for reheating tray packs. The unit is electrically operated and thermostatically controlled. The unit is provided with electric heating elements which clamp on to the 3/8" thick stainless steel clad plate. This pan operates on a 208-volt, 60-Hertz (Hz), three phase system. Rated wattage is 4.5 kilowatts (kW). Its overall dimensions are width 59", depth 36–1/2" (front to back), and height 40". The braising pan body is 9" deep.

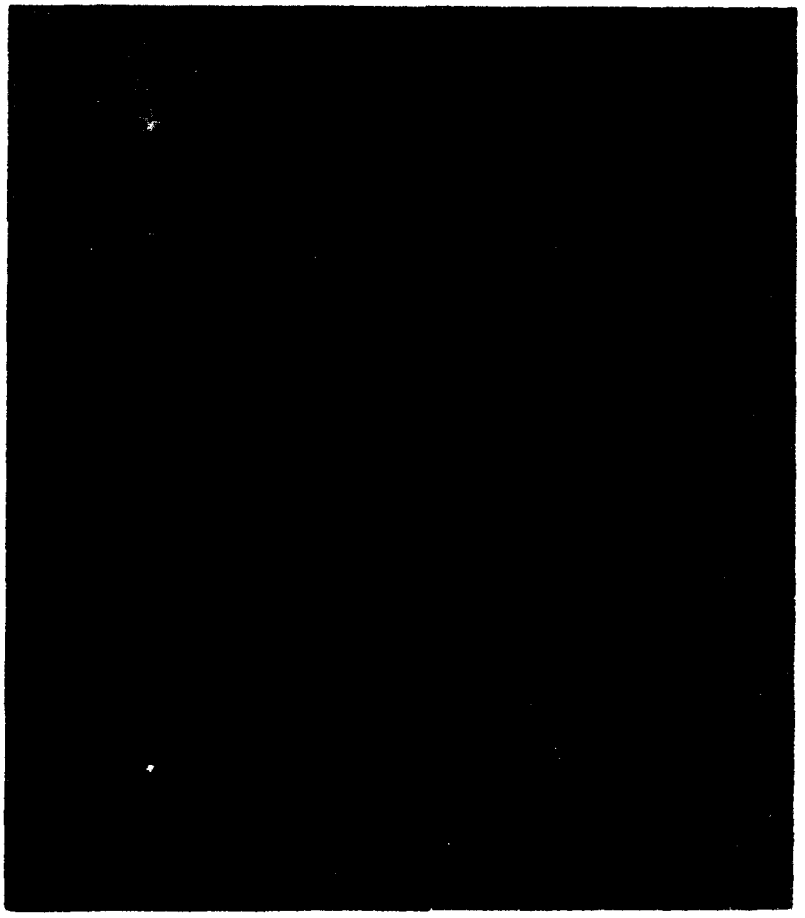

Figure 6. Tilting, Frying and Braising Pan

*Item numbers are assigned to all NHE equipments to facilitate equipment location in the system layout shown in Figure 5 and pertinent data located in Table 11.

Performance. This appliance was the most utilized and appreciated hardware item in the New Harvest Eagle kitchen. An equipment utilization survey conducted during the maximum feeding period showed the tilt pan was in use 83% of the time during meal preparation periods. During interviews, cooks volunteered that the tilt pan was their favorite appliance.

In part, the heavy use and high appreciation of the tilt pan at Kim Hae were due to the failure of the ovens. Most oven functions were performed by the tilt grill. The varied application of this item (from cooking stew to heating T-rations) and its high reliability and ease of cleaning made it a most popular and practical equipment for field kitchen use.

Deep Fat Fryer, Electric (Item 2):

Description. The deep fat fryer (Figure 7) is rated to produce up to 15 servings of quartered chicken per hour or up to 90 lbs of french fries (raw to done) per hour at a 350°F temperature setting. The fryer operates on a 208-volt, 60-Hz, three-phase system. Rated wattage is 18 kW. Its overall dimensions are width 20", depth 38", and height 39–3/4" (legs not raised).

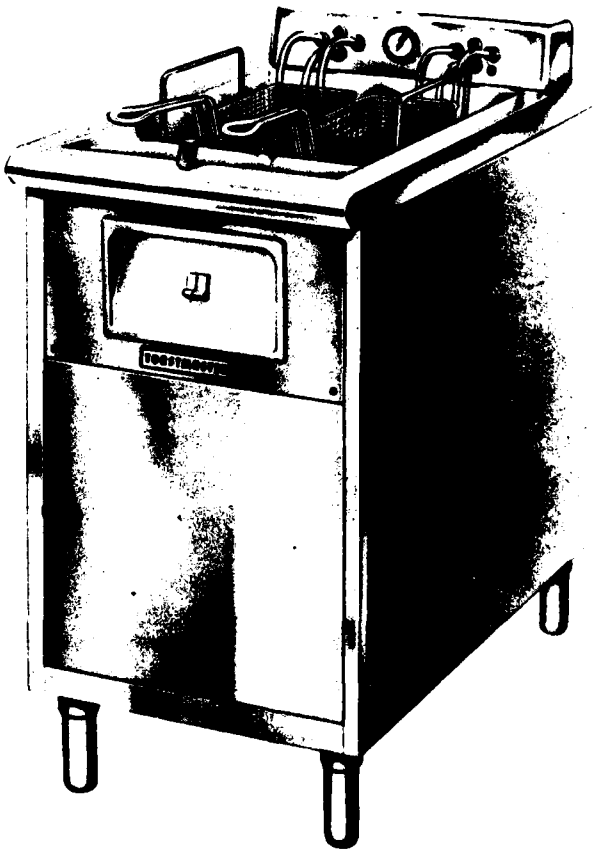

Figure 7. Deep Fat Fryer

Ventilator, Proximity (Item 3):

Description. The proximity ventilator (Figure 8) is a self-contained stainless steel modular unit designed to vent any combination of cooking equipment. The electrically powered unit was banked with the deep fat fryer and utilized the rear bottom discharge. The unit operates on 208-volt, 60-Hz, one-phase system. Rated wattage is 1.83 kW. Overall dimensions are width 18", depth 30" and height 48".

Filter, Grease (Item 4):

Description. The grease filter (Figure 9) is designed to filter and return the hot liquid shortening compound in the deep fat fryer cooking vessel. The filter operates on 120-volt, 60-Hz, one-phase system. Rated wattage is .9 kW. Its overall dimensions are width 18", depth 24" (front to back). and height 27".

Figure 8. Ventilator, Proximity

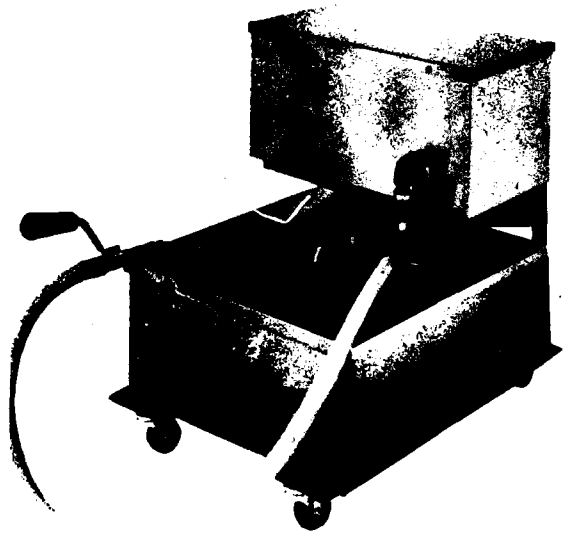

Figure 9. Grease Filter

Performance. The deep fat fryer and banked ventilator were useful additions to the field kitchen. Fried items, in particular, chicken and french fries, were very popular with troops and were made available frequently and in quantity. During the equipment utilization study, the fryer was in use 52% of the time. Most cooks (88%) rated the capacity of the fryer as adequate; however, the low meal attendance rate implies a larger production capacity fryer may be needed should substantially more meals be required. The grease filter at Kim Hae was not used; no explanation was offered.

Automatic Potato Extruder (Item 5):

Description. The automatic potato extruder (Figure 10), designed for electric operation, is rated to produce 600 oz (171, 3–1/2 oz portions) of formed potato pieces per hour. The potato extruder hopper dry product capacity is approximately 15 pounds which produces about 200 servings of raw product. This capacity is doubled when a hopper extension is added. A complete set of extruder dies consists of a 1/4" and 5/16" crinkle cut slicer, cottage fries slicer, and steak cut slicer. The unit operates on a 120-volt, 60-Hz, one-phase system. Its overall dimensions are width 26", depth 26", and height 26".

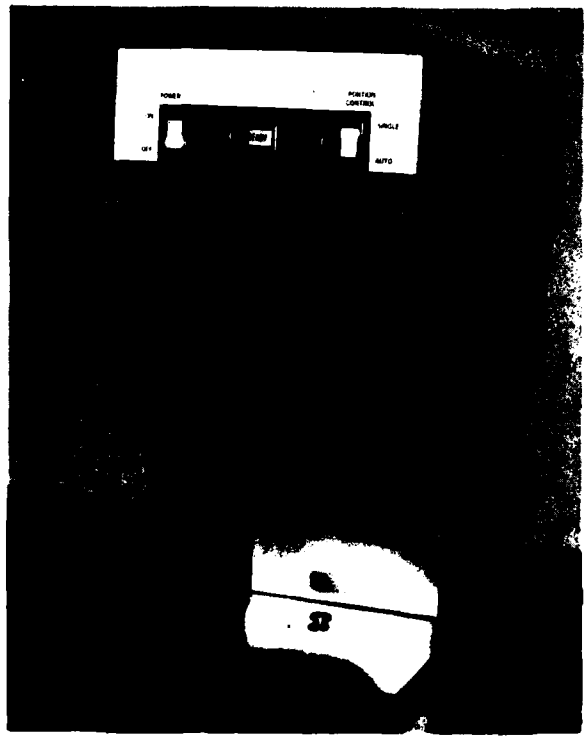

Figure 10. Automatic Potato Extruder

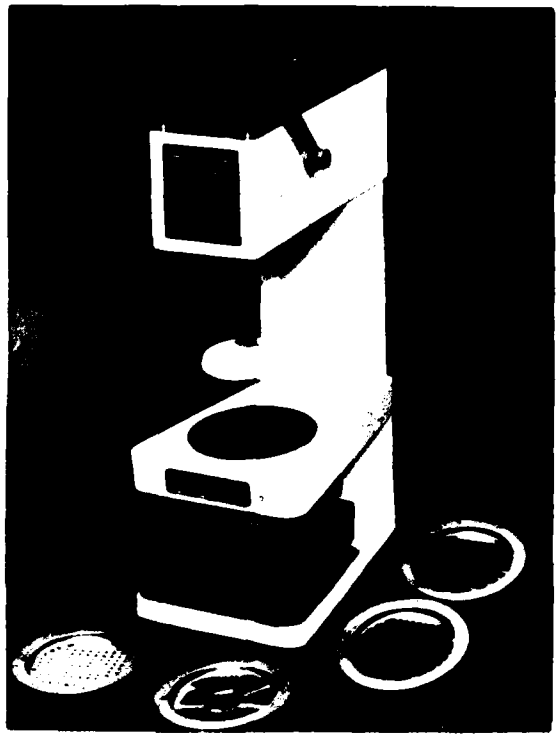

Figure 11. Manual Potato Extruder

Manual Potato Extruder (Item 6):

Description. The manual potato extruder (Figure 11) uses the same product as the automatic potato extruder. The cylinder holds 39.5 oz of dry product and when rehydrated, produces 24, 1–1/2 oz servings. Its overall dimensions are width 9.5", depth 15", and height 35".

Performance. Both extruders were operated at Kim Hae and all cooks were trained in their use. During the heavy feeding phase of the exercise, the automatic extruder was used exclusively. The extruder units, totally new to field feeding systems, made it possible to offer french fried potatoes without the normal large requirement for refrigeration and/or dry storage. The extruders used a mix of vitamin C enriched dehydrated potato granules which required minimum storage space and no refrigeration. The extruder was in use 40% of the time during the equipment survey. Cooks gave this machine high ratings, with 83% indicating it was adequate and 21% indicating it was what they liked best about the New Harvest Eagle. No maintenance problems were encountered with the extruders.

Griddle Assembly (Item 7):

Description. The griddle assembly (Figure 12) is the knockdown type and is heated by two burner units. The griddle assembly conforms to the requirements of purchase description MC–6 (see Figure 11).

Figure 12. Griddle Assembly

Performance. The two griddles on the double serving lines were more than adequate to serve the breakfast meal; only one griddle was used at most breakfasts. During the infrequent short order menu offering, the griddle on the short order side of the serving line was overutilized due to the high popularity of the short order items. The griddles were slightly modified after the Eglin feasibility test by lowering the handle of the grease outlet plug. Previously, the handle interfered with cooks' hand/arm motions causing burns from the rear edge (lip) of the griddle. No burn or inconvenience problems were reported by cooks at Kim Hae, although several cooks suggested the griddle should be larger. Only one side of the reversible griddles was used and no unusual wear was observed. Each griddle was fired by two burner units which provided appropriate amounts of heat. The heat exhaust stack afforded adequate protection to customers and workers.

Cook Pot Assembly (Item 8):

Description. The cook pot assembly (Figure 13) consists of a cook pot cradle modified with a stainless steel shroud to direct the heat to the 60-quart cook pot from the modified burner. This unit is placed on the burner frame.

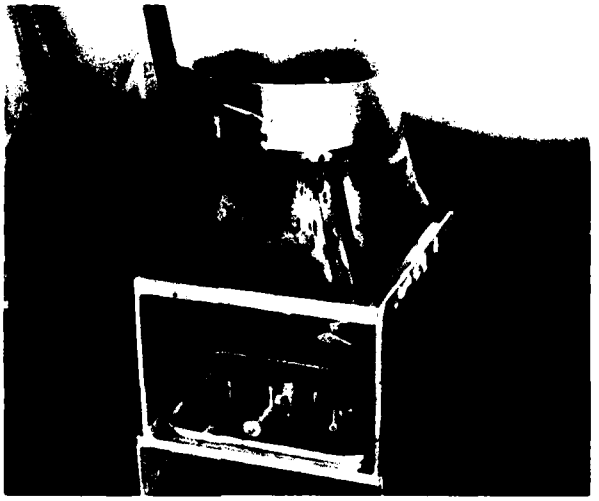

Figure 13. Cook Pot Assembly

Performance. Three cooking pots fitted with energy saving faring were used during the Korean evaluation. The three were seldom used at the same time due to the low meal attendance rate. The equipment survey showed two pots in use 56% of the time, and a single pot in use 22% of the time. The cook pots were used for a variety of food preparation tasks including heating T-rations. Although meal production capacity was not rigorously tested at Kim Hae, it is felt that three cook pots are sufficient to meet design requirements.

Oven, Field Assembly (Item 9):

Description. Figures 14 and 15 show the field oven assembly in closed and open door positions. The oven is a single compartment, stainless steel unit capable of holding two roasting pans. The oven was placed on a burner frame and heated by a single burner unit.

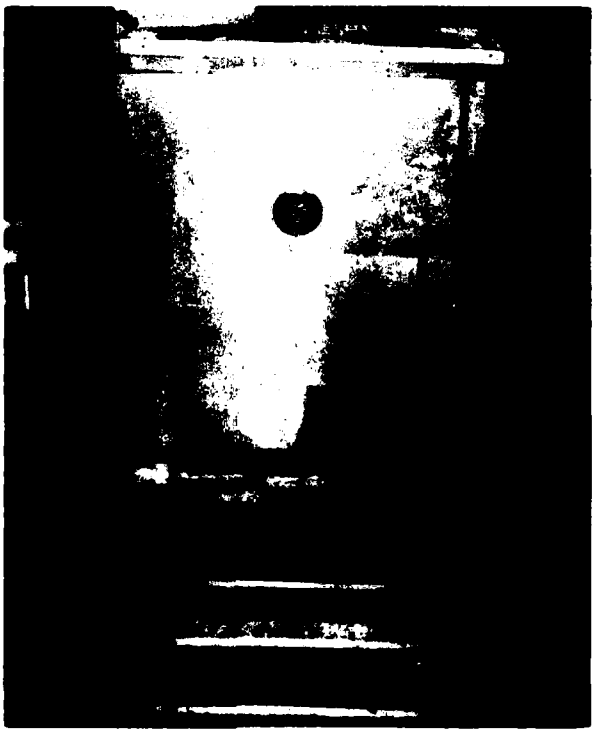

Figure 14. Closed Oven Assembly

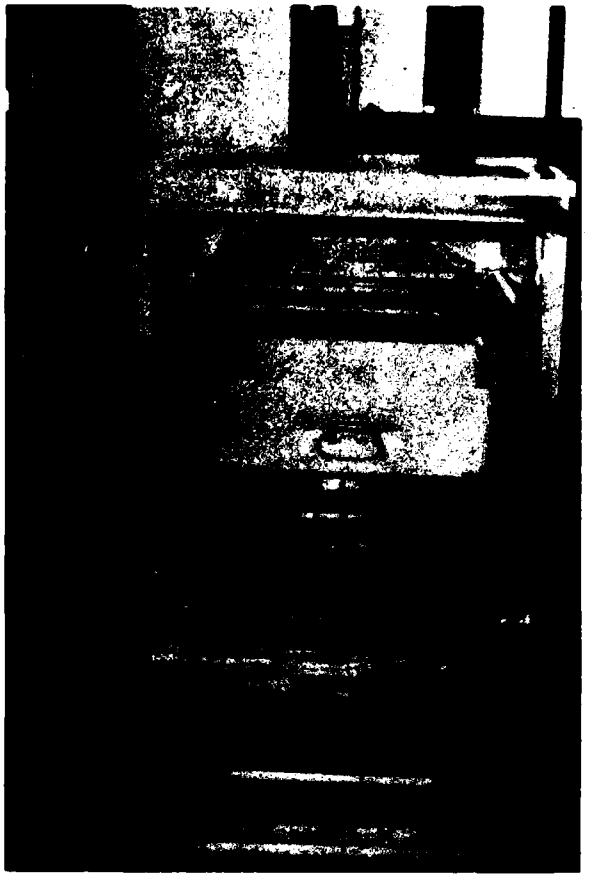

Figure 15. Open Oven Assembly

Performance. Four field ovens were included in the field kitchen assembly. At the Eglin AFB test, the ovens reached baking temperatures and were used as planned during the limited feeding operation. At Kim Hae, the ovens could not be brought to cooking temperatures and, consequently, were used almost exclusively as warming cabinets. During the equipment utilization survey, three ovens were used at the same time 33% of the time, two were in use 22% of the time, and one oven was used 5% of the time. Due to their heating problem, the ovens received low evaluation ratings from the cooks. However, NLABS engineers believe the oven design is appropriate and the ovens will function as required when sufficient burner temperatures are obtained.*

Coffee Dispenser (Item 10):

Description. The coffee dispenser (Figure 16) is designed to accurately dispense a predetermined quantity of freshly ground coffee with each dispensing lever action. The quantity of coffee dispensed is adjustable from 1–1/2 oz. to 3–1/2 oz. in 1/4 oz increments. The unit's bin capacity is 7 lbs. Its overall dimensions are width 9", depth 11–7/8", and height 19–3/4".

*As explained earlier in this report (page 47), the temperature problem was caused by faulty burner generators, not the oven design.

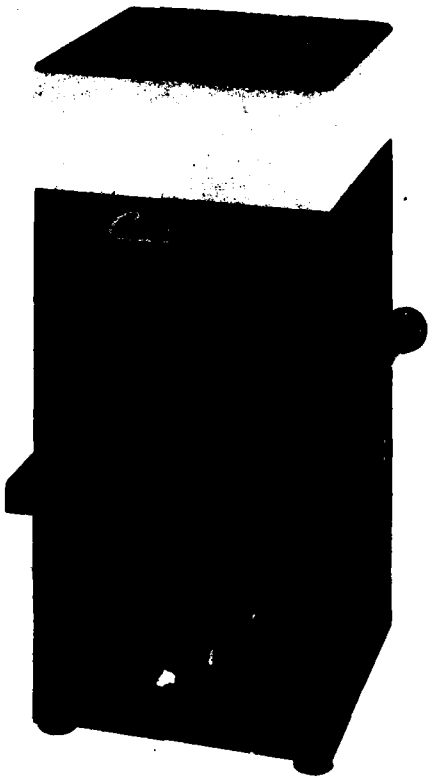

Figure 16. Coffee Dispenser

Performance. The dispensers were operated as planned and served an important function as part of the coffee making system. With the dispensers, quality control was assured. The manpower requirement was minimized since customers were readily able to make their own coffee. The high quality of the coffee was noted by customers and workers.

Coffee Brewer, Automatic, Five-Pot (Item 11):

Description. The five-pot stainless steel coffee brewer (Figure 17) is provided with one brew head and four warmers, one of which heats water to boiling temperature. The coffee brewer operates on 208-volt, 60-Hz, one-phase system. Rated wattage is 4.6 kW. Its overall dimensions are width 24", depth 18–1/2", and height 23–3/4". The coffee brewer is provided with five stainless steel decanters.

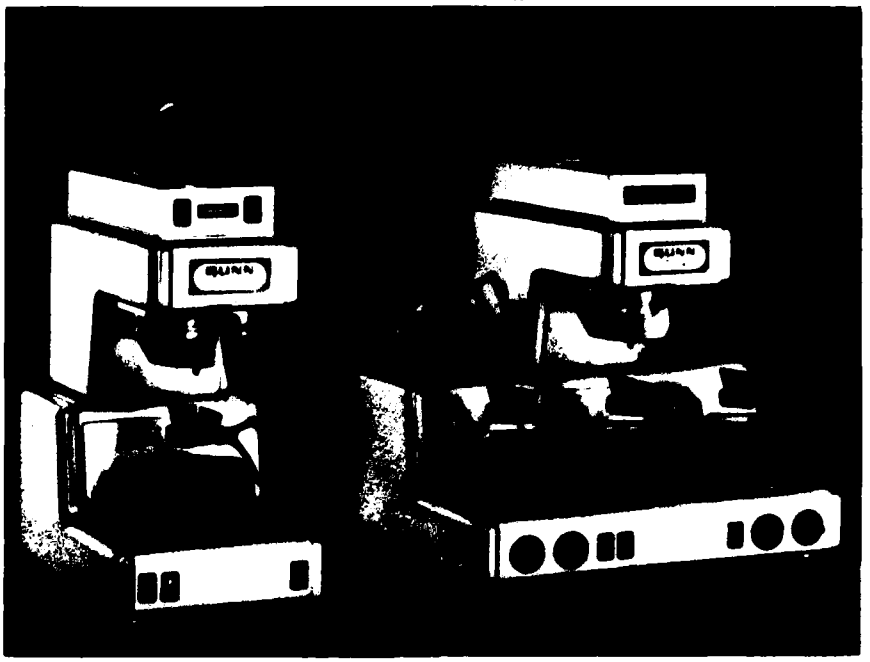

Figure 17. Two-Pot and Five-Pot Coffee Brewers

Coffee Brewer, Automatic, Two-Pot (Item 12):

Description. The two-pot stainless steel coffee brewer (Figure 17) is provided with one brew head and one warmer. The coffee brewer operates on 120-volt, 60-Hz, one-phase system. Rated wattage is 1.8 kW. Its overall dimensions are width 12", depth 18–1/2", and height 23–3/4". Additional coffee brewer information may be located in Table 11.

Performance. Two five-pot drip coffee brewers were located in the dining area and, with the dispensers mentioned above, were planned as a self-service coffee system. The quality of the coffee was rated very high by customers. Hot water was made available to customers in a decanter heated by a Calrod unit on the coffee brewer. The hot water was used for tea and to dilute brewed coffee for those who liked their coffee weaker. At times, customers did make their own coffee; however, cooks made the coffee most of the time. Some difficulty was experienced with burned out thermostats. After replacing the thermostats the brewers operated without difficulties. A two-pot coffee brewer for cooks' use was located in the vegetable preparation area but was seldom used.

Vegetable Slicer (Item 13):

Description. The vegetable slicer (Figure 18) is designed for electrical operation. It is capable of slicing, shredding, chopping, or grating vegetables up to 1000 pounds per hour. The slicer operates on 120-volt, 60-Hz, one-phase system. Rated wattage is 0.62 kW. Its overall dimensions are width 14–1/2", depth 26", and height 22".

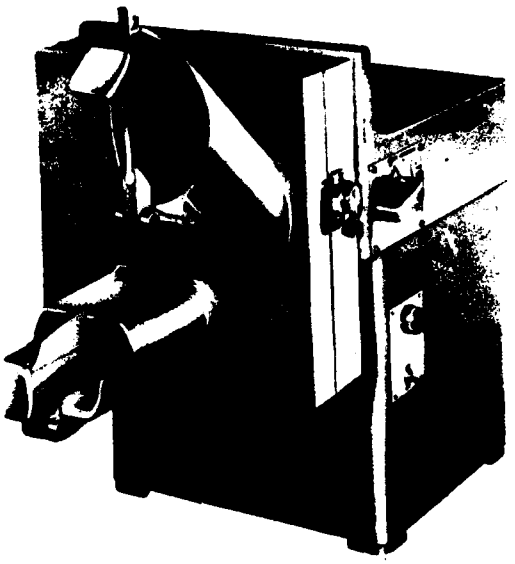

Figure 18. Vegetable Slicer

Performance. The vegetable slicer was located in the vegetable preparation area, and though available throughout the exercise, was used only once. Cooks reported the slicer was not used since seldom were fresh vegetables brought to the site. The slicer worked well during cook training sessions and during its one application; however, a valid operation assessment of the appliance cannot be made on the basis of the Korean experience.

Meat Slicer (Item 14):

Description. The meat slicer is designed for electrical operation. The meat slicer operates by manual or gravity feed at the rate of 40 slices per minute. It is a 120-volt, 60-Hz, one-phase system. The slicing knife diameter is 10" minimum and the slice thickness is 3/8 maximum. Additional meat slicer information can be obtained from Table 11.

Performance. The slicer was used during the feeding operation at Kim Hae. The equipment utilization survey recorded the slicer in use approximately two hours during the 30-hour sample. No maintenance or operational problems were identified with this standard item.

Can Opener, T-Rations (Item 15):

Description. The T-ration opener (Figure 19) is table mounted with a base plate secured to the table top. The can opener is the bayonet-type and conforms to the requirements cited in Table 11.

Figure 19. Can Opener, T-Rations

T-Ration Safety Lifter (Item 16):

Description. The T-ration safety lifter (Figures 20 and 21) is fabricated of stainless steel and is capable of removing a 1/2 size T-ration pan as shown in Figure 21. Additional T-ration safety lifter information can be obtained from Table 11.

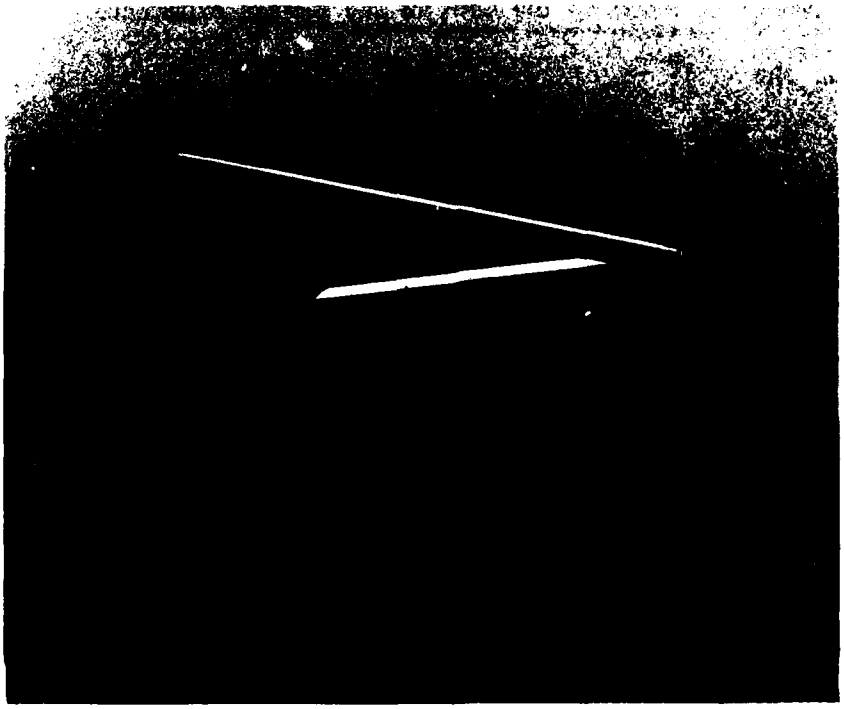

Figure 20. T-Ration Safety Lifter

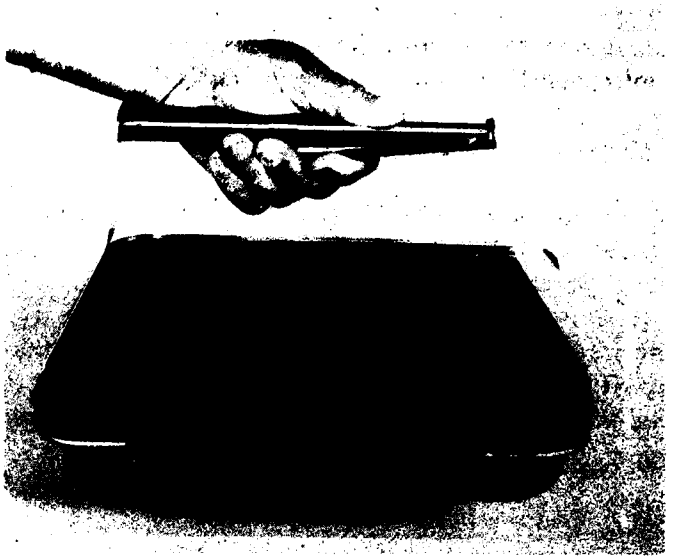

Figure 21. T-Ration Safety Lifter in Use

Performance. The two openers were sufficient to open the quantity of T-ration cans served at Kim Hae. Three openers were included in the kit and it is recommended that a fourth be added for operation at full capacity. The openers worked well enough to meet the requirement at Kim Hae; however, to accommodate higher volume T-ration feeding, an improved opener should be designed to increase the use and speed of tray pack opening. The lifter used at the Korean test worked well and represented an improvement over previous lifters. Cooks had no difficulty in retrieving T-ration cans from hot water, and after opened, placing them in steamtable wells.

Sink, Vegetable Preparation (Item 17):

Description. The stainless steel vegetable preparation sink (Figure 22) conforms to the dimensions specified on the NLABS sketch referenced in Table 11.

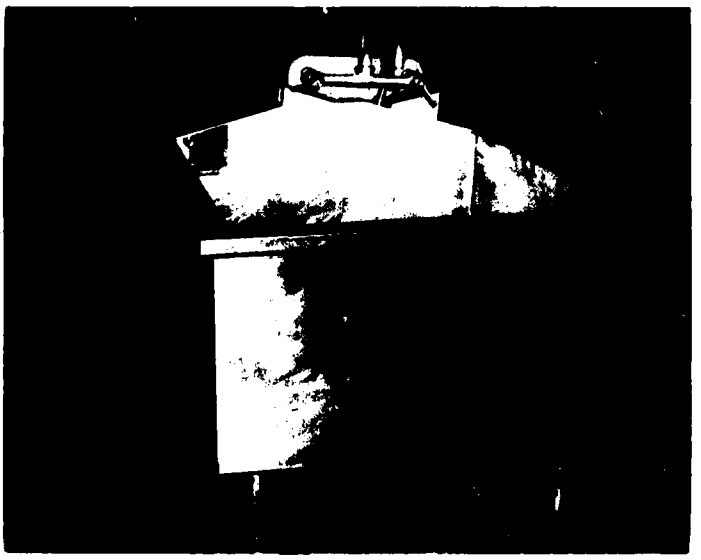

Figure 22. Vegetable Preparation Sink

Performance. The sink was located in the sanitation/vegetable preparation/storage shelter, and though hooked up during the entire 35-day feeding period, it was seldom used. Fresh vegetables were used infrequently at Kim Hae primarily due to their unavailability.

Ice Making Machine, Cube, Automatic (Item 18):

Description. The ice making machine is capable of making cubed ice automatically. The unit has a dispensing capacity of 400 lbs per 24-hour period. Additional ice making machine information can be obtained as indicated in Table 11.

Performance. The ice maker was not included as a test item in the Kim Hae evaluation. However, the hospital staff at the exercise requested the unit be hooked up and made available to them. The machine was then installed in the sani/storage shelter and worked well on a limited use basis.

Toaster, Conveyor, Electric (Item 19):

Description. The electric conveyor toaster is the continuous-type with a capacity of 540 slices of toasted bread per hour. Additional conveyor toaster information can be obtained from Table 11.

Performance. Two toasters were located in the dining shelter and provided toast as a self-service item. The toasters were used daily and functioned without problems.

Table, Food Preparation (Item 20):

Description. The food preparation table is leg mounted and fabricated of stainless steel. The top working surface and the shelf under the working surface are of one piece construction. Additional food preparation table information is included in Table 11.

Performance. The food preparation tables were preassigned to locations within the kitchen and sani/storage shelters, but cooks were told to move the tables as their work indicated. After a short work experience, the staff rearranged the tables placing one between the serving lines, one adjacent to the deep fat fryer, another in the kitchen area adjacent to the tilt grill, and one in the vegetable preparation room. This arrangement proved beneficial, and the tables were used extensively.

Food Serving Equipment

Warming Cabinet (Item 21):

Description. The warming cabinet (Figure 23) is designed for electrical operation with the temperature thermostatically controlled. The unit is capable of holding 34 sheet pans and is mounted on casters. The warmer is designed for operation on 120-volt, 60-Hz, one-phase system. Rated wattage is 1.5 kW. Its overall dimensions are width 23–3/16", depth 33–1/2", and height 69–3/4".

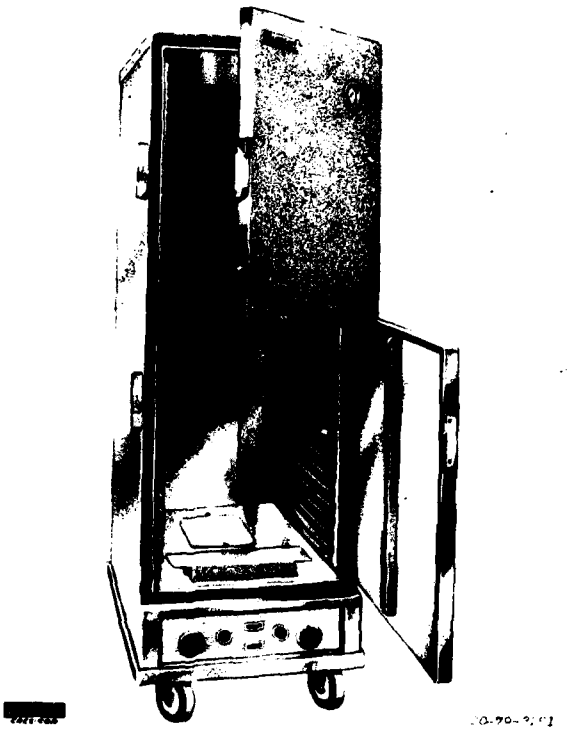

Figure 23. Warming Cabinet

Performance. The principal function of the two cabinets was to store and keep warm heated food items awaiting serving, particularly T-rations. The cabinets made it possible to build a sizeable inventory of T-ration items ready for serving, thus avoiding shortages on the serving line during heavy feeding periods. No loss in product quality was observed as a result of the pre-serving storage. The cabinets were in use continuously during kitchen operations with both in use 67% of the time and a single cabinet on line 30% of the time. These findings indicate the important contribution of the cabinets to the foodservice operation. No problems were reported in using the cabinets; however, the door handles on the cabinets were of an unconventional design, and cooks found them somewhat awkward to operate.

Steamtable Assembly, Three-Well (Item 22):

Description. The three-well stainless steel steamtable assembly with attached, removable fourth well (Figure 24) is a knockdown table and conforms to the requirements of purchase description MC–6 (see Table 11).

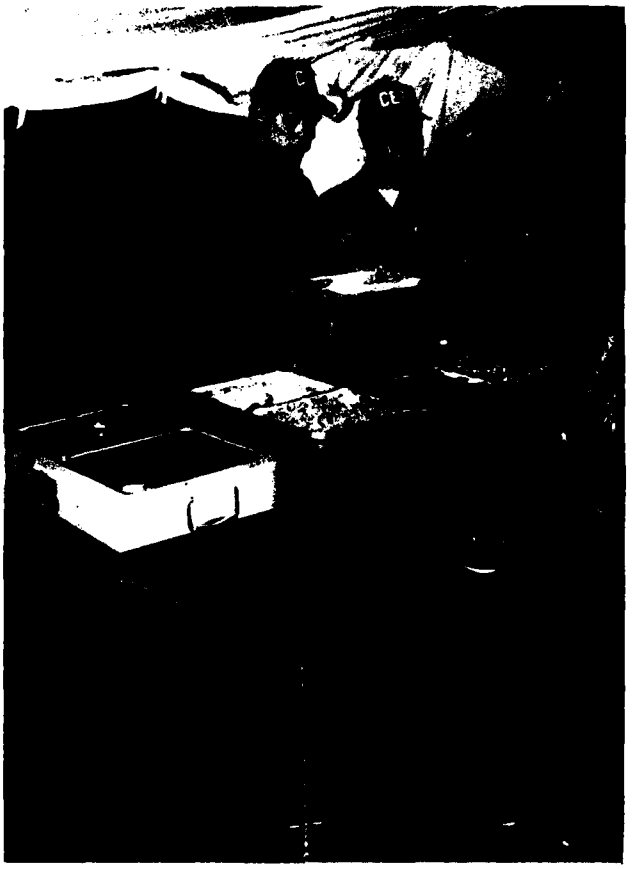

Figure 24. Steam Table Assembly – Three-Well Plus Fourth Well Attachment

Performance. The addition of an attached removable fourth well to each of the three-well steamtables proved useful. The two tables easily met the food serving requirement at Kim Hae. Four-well steamtables are recommended for feeding an 1100 troop deployment, and presently a burner-heated, four-well table is being designed. (Heretofore, only electrical powered steamtables had four wells.) The single burner unit under each steamtable provided adequate heat.

Dispensers (Items 23 and 24):

Description. The beverage dispenser and the milk dispenser are of the double-well polyethylene type with foamed in place insulation. This unit is designed to keep beverages at serving temperature, does not retain odors, and is easy to clean. The dispenser capacity is five gallons and it is provided with a recessed faucet.

Performance. Beverage Dispenser – Two beverage dispensers were placed in the dining area for customer self-service. Two dispensers at a time are adequate where the feeding requirement is at the Kim Hae level, approximately 1000 meals daily. Four dispensers would be required where larger numbers are fed and/or where very hot ambient temperatures exist.

Performance. Milk Dispenser – Milk consumption at Kim Hae was low and two five-gallon dispensers were more than enough. The dispensers functioned without problems.

Sanitation Equipment

The equipment and design of the sanitation system proved to be efficient and capable of handling the sanitation requirment at Kim Hae. The sanitation system was designed to reduce labor and to provide a quality field sanitation system, something previously lacking in the Air Force field feeding inventory. All cleaning and sanitation work was performed by cooks; no "KP's" were rostered from the deployment. When interviewed, no cooks volunteered negative comments about the sanitation work, while 96% commented favorably on the sanitation system. A comprehensive report on the field kitchen was submitted by the veterinary team at Kim Hae and is included in this report as Appendix J. CPT Smitherman, Chief, Veterinary Services and his team from the 655th Tactical Hospital were highly complimentary regarding the total food system and, in particular, the sanitation system.

Sanitizing Sink with Two Drain Tables (Item 25):

Description. The sanitizing sinks with two drain tables (Figure 25) are fabricated of stainless steel. One of the three sinks was provided with one burner unit for sanitizing. Other components of the sanitizing equipment are identified in the document cited in Table 11.

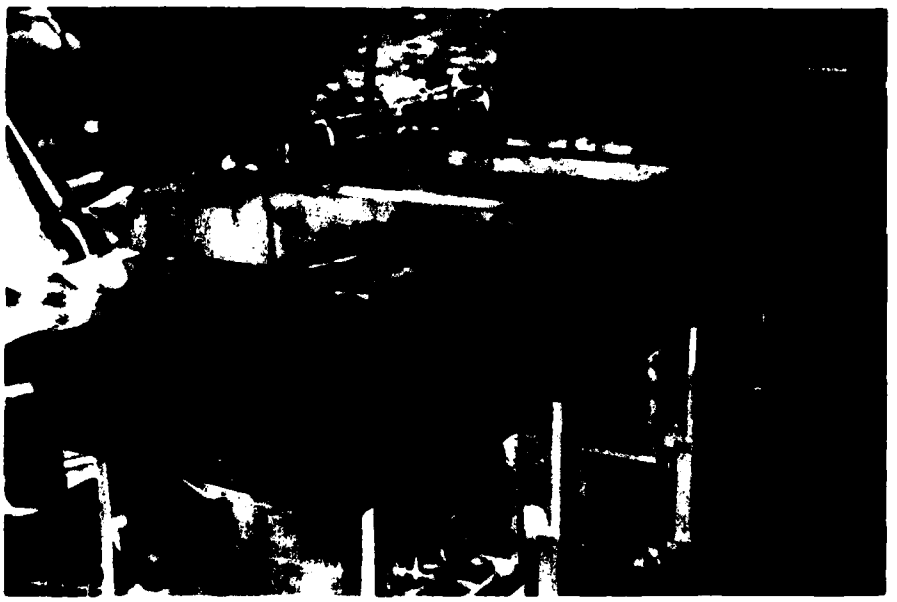

Figure 25. Sanitizing Sink Assembly

Performance. The three sink assembly with accompanying drain tables worked well and was rated superior by the veterinary group. Vinyl floor covering prevented dirt and grease absorption by the plywood floor and greatly facilitated floor cleaning.

M–80 Hot Water Assembly (Item 26):

Description. The M–80 hot water assembly (Figure 26) provided hot water to the sanitary sinks and to the hand washing sink. It also provided cold water to the coffee brewers, the automatic potato extruder, the cooking pots, and the sinks. All components are identified under the document cited in Table 11.

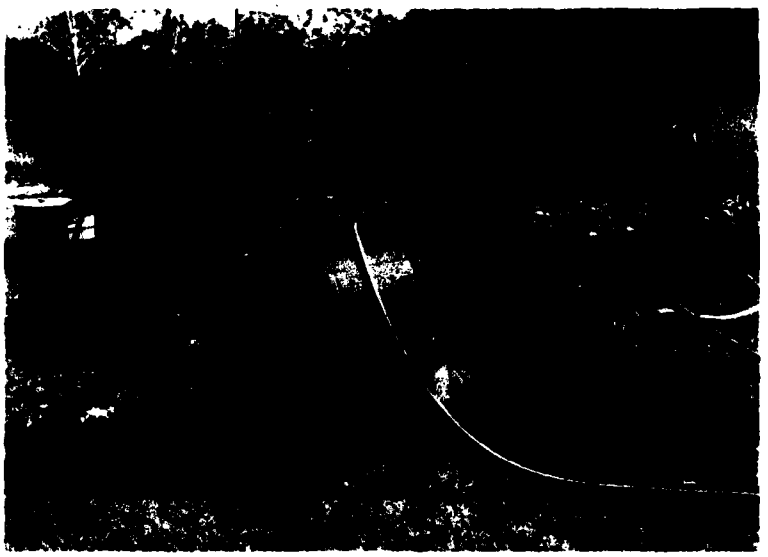

Figure 26. Hot Water Assembly

Performance. The hot water assembly provided ample hot water for cleaning and sanitizing. In a sample of 13 readings, 52°F water was heated and delivered to the three sink assembly at 170°F. A burner unit was positioned under one of the sinks to maintain a sanitizing temperature, thereby assuring effective sanitation while conserving water. Simple preventive maintenance functions were performed by foodservice personnel. No corrective maintenance was required on this unit during the evaluation. The burner consumed diesel fuel at a five-gallon per hour rate.

Grease Trap Assembly (Item 27):

Description. The grease trap (Figure 27) is fabricated of plywood and consists of panels and baffles assembled to form a single unit. This assembled unit is set in the ground with the cover flush with the ground. The unit contains a drain system with an electric heater and an electric driven sump pump. The grease trap assembly and the drain system are covered in detail by the NLABS drawings cited in Table 11.

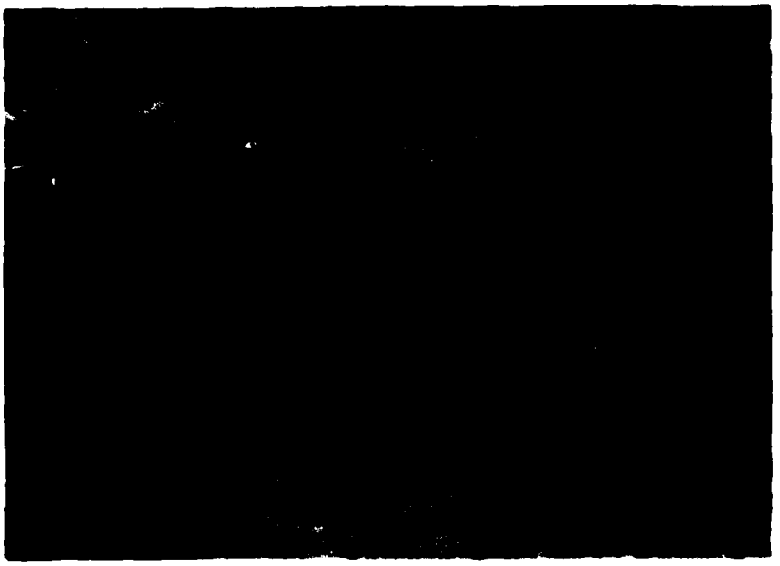

Figure 27. Grease Trap Assembly

Performance. No problems were observed with the grease trap. Its capacity was adequate for the Kim Hae requirement.

Storage Racks (Item 28):

Description. The storage racks (Figure 28) are the knockdown-type and are referenced in Table 11. The overall dimensions of the rack are width 18", length 48", and height 63'.

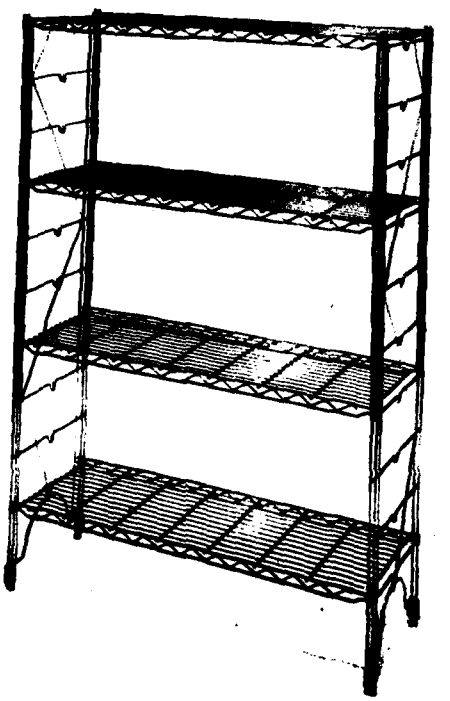

Figure 28. Storage Racks

Performance. Two racks were located in the sanitation area adjacent to the three-sink assembly. These racks provided sufficient storage space for sanitized pots, pans, and utensils.

Hand Washing Sink (Item 29):

Description. The stainless steel hand washing sink (Figure 29) is a single compartment sink. Additional hand washing sink information can be obtained from Table 11.

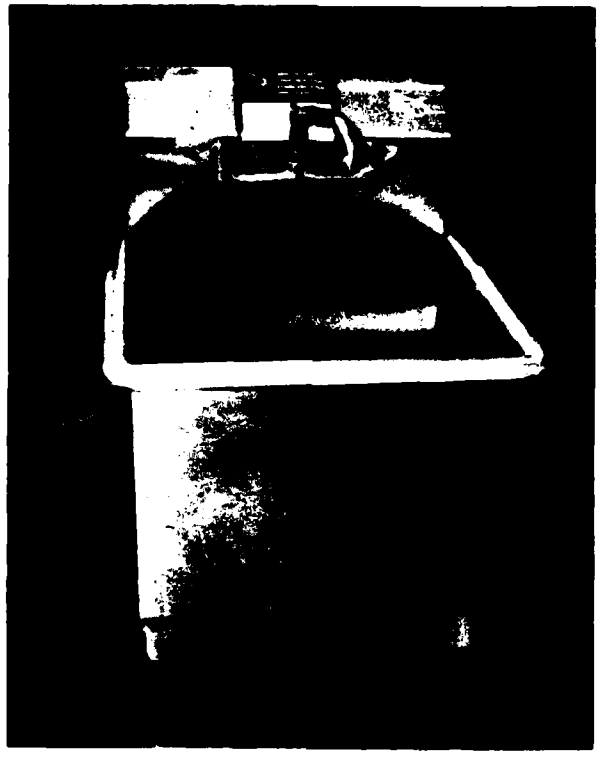

Figure 29. Hand Washing Sink

Performance. The hand washing sink for cooks was located in the kitchen and was used as intended. In addition, the sink was occasionally used to clean utensils and other items. This was the first hand washing sink provided for cooks in the field and they found it useful for a variety of cleaning tasks. Sanitation officers commented favorably on the importance of having the sink in the system (see Appendix M).

Refrigeration Equipment

Refrigerator, Mechanical, Portable, Walk-In Type, 150 cu ft Capacity (Item 30):

Description. The 150 cu ft capacity portable walk-in refrigerator is provided with an electric driven compressor unit. The refrigerator and compressor unit conform to the documents cited in Table 11.

Performance. As anticipated, three walk-in refrigerators were sufficient to hold all food products requiring refrigeration. A design feature of the New Harvest Eagle is its low refrigeration requirement made possible by offering a T-ration meal daily, by using dehydrated potato mix for deep fried potatoes rather than fresh potatoes, and by eliminating fresh refrigerated milk. At no time during the 35-day feeding period were all three refrigerators filled. It must be pointed out, however, that a higher meal attendance rate and/or infrequent ration delivery may increase the refrigeration requirement.

Refrigerator, Upright Reach-In (Item 31):

Description: The upright stainless steel refrigerator (Figure 30) has a capacity of 21.7 cu ft. The unit operates on 120-volt, 60-Hz, one-phase system. Rated wattage is 0.73 kW. Its overall dimensions are width 27–3/8", depth 35–1/2", and height 83–1/8".

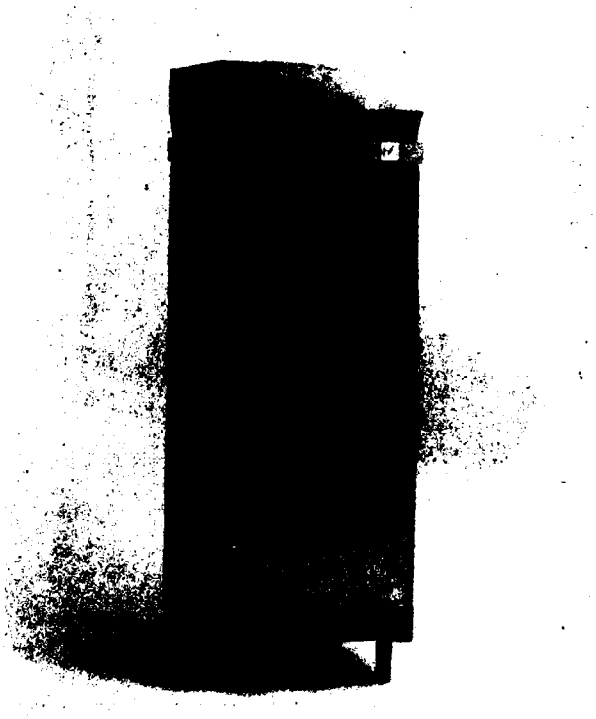

Figure 30. Refrigerator, Upright Reach-In

Performance. The reach-in refrigerator was used exclusively in support of the breakfast meal and the short order menu. The considerable height and weight of the refrigerator caused some pre-test concern; however, the refrigerator was not a problem to move, and it fit with ease under the kitchen shelter liner. Cooks' comments were favorable regarding the capacity and operation of the refrigerator.

Dry Storage Equipment

Storage Shelving Assembly (Item 32):

Description. The storage shelving (Figure 31) is the knockdown type and conforms to the requirements cited in Table 11. Overall dimensions of the completely assembled storage shelf assembly are width 48", depth 24", and height 63".

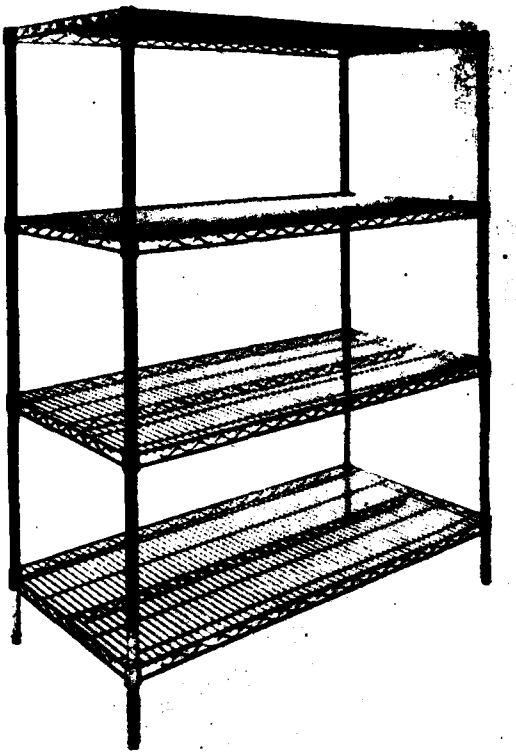

Figure 31. Storage Shelving Assembly

Performance. In the sanitation/vegetable preparation/storage shelter, five tent sections were utilized for dry storage and administrative work areas for the storekeeper and personnel. The storage area (40' x 20') and the four shelves used for storage were adequate when the supply of stocks was well organized. A notable feature of the shelter system is its modularity; i.e., more sections can easily be added when needed. Should a feeding requirement much larger than the Kim Hae requirement be anticipated, or should the distance to a supply source be such that infrequent ration deliveries are planned, additional sections and shelving may be needed.

The Remote Tank-Burner System

The major components of the burner system as fielded at Kim Hae, Korea during Team Spirit '81 are described below. Some refinements will undoubtedly be made to various components of the system; however, with the exception of the safety valve, the hardware and system configuration shown will be recommended for Air Force acceptance.

Main Fuel Supply Tanks:

Description. Two air-pressurized 60-gallon fuel tanks supply fuel to the burners. Designed for continuous operation, the two-tank system makes alternate day filling of a single tank possible. Quick disconnect fittings on the tanks facilitate switching tanks. Protective caps for the quick disconnects were ordered, but not received in time to be included in the Korea test. As shown in Figure 32, the tanks are fitted with flame arrestors, a pressure relief valve, an air pressure gauge, a fill opening, and an electrical grounding unit. An excess flow valve is positioned in the main line leading from the tanks. Should a rupture in any of the fuel lines occur, the valve automatically closes off the flow of fuel to the entire system.

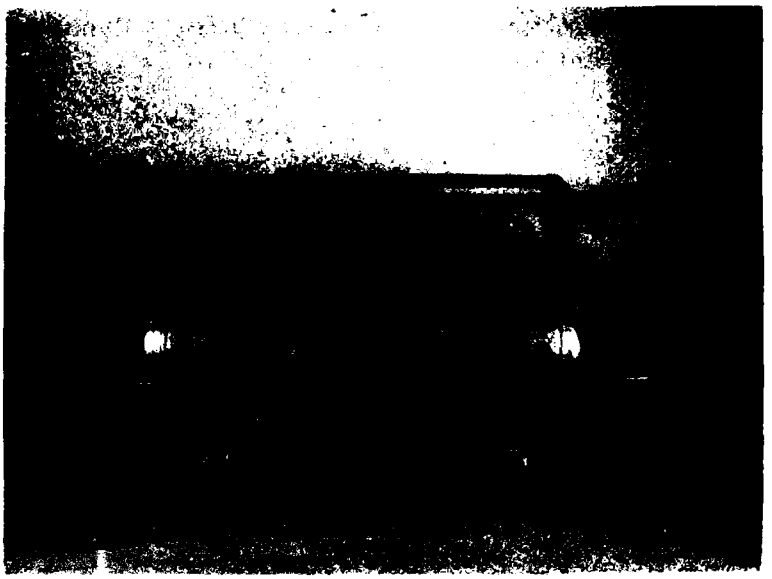

Figure 32. Main Fuel Supply Tanks

Performance. The main fuel tank system operated satisfactorily during the Kim Hae test. Refilling was done on a three-day schedule. A slight problem was observed when gasoline squirted from quick disconnects apparently caused by dirt in the disconnect. The addition of dust caps to the disconnects is expected to remedy the problem.

Portable Air Compressor:

Description. The portable air compressor (Figure 33) with a 15-gallon supply tank provided compressed air to the fuel tanks. It is equipped with a manual ON/OFF switch, a pressure relief safety valve, and an automatic pressure regulator which turns the compressor "ON" when the pressure within the supply tank drops to 70 psig and "OFF" when the pressure reaches 150 psig. A second regulator in the outlet line of the supply tank maintains a constant system operating pressure.

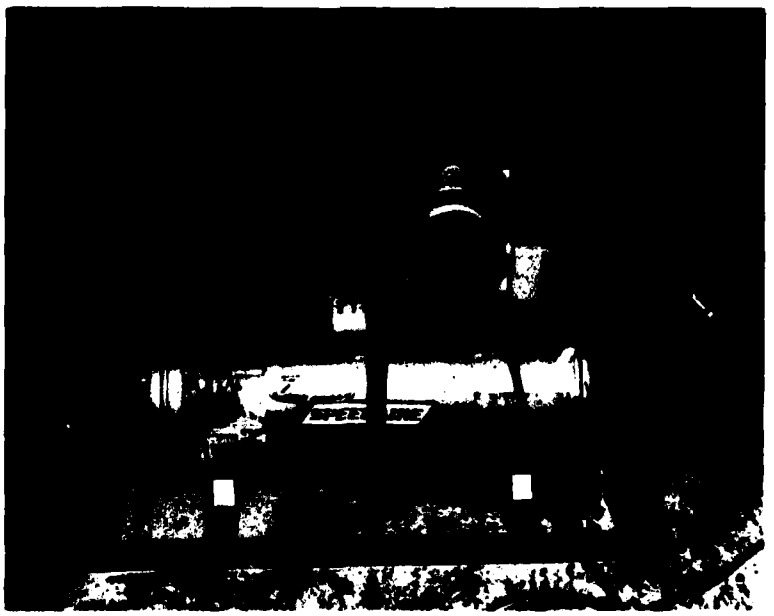

Figure 33. Portable Air Compressor

Performance. The compressor provided adequate air pressure throughout the field test. No problems with this equipment were observed.

Fuel Lines:

Description. Extruded Teflon lines protected by braided steel wire were configured and fitted as shown in Figure 88 in the Instructional Manual. Quick disconnects and flare swivel end fittings were attached.

Performance. The system worked well, except some gasoline dripping occurred when fuel tanks and burner units were changed. The configuration design was adequate and is recommended for the basic New Harvest Eagle Complex. The composition of the lines themselves was adequate, and no unusual wear on the lines was observed. This type line is recommended for further use in the New Harvest Eagle.

Tankless Burner Unit:

Description. The tankless burner unit was equipped with a quick disconnect fitting and a safety valve. The disconnects were designed to permit easy handling of the burners and to prevent gas dripping while connecting and disconnecting under pressure. Figure 34 shows a tankless burner with the quick disconnect fitting and the safety shut-off valve. Figure 35 is a close-up of the safety valve.

Figure 34. Tankless Burner Unit with Safety Shut-Off Valve

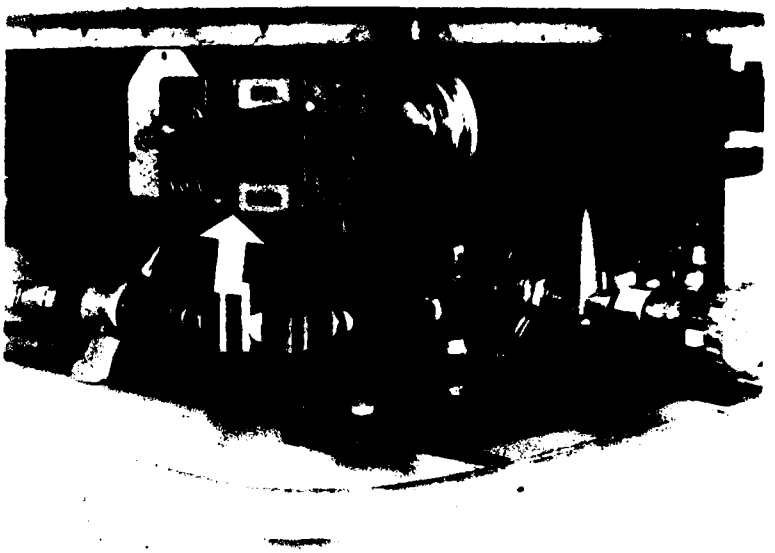

Figure 35. Close-Up of the Safety Valve

Performance. Fourteen burner units were installed in the New Harvest Eagle system tested at Kim Hae. An additional ten units were deployed as back-ups. The units were lighted in place without incident. Cooks and others observed that these units were safer and easier to operate than the standard M–2A burners. The units operated well after a faulty safety valve was replaced by a simple brass fitting on each unit. Btu output was not measured; however, all appliances with the exception of the four ovens were heated to operating temperatures.

In-Line Safety Valve:

Description. The shut-off safety valve was designed to close automatically, shutting off the fuel line to the burner when line pressure drops below 5 psi. The valve is opened only by manually repositioning the valve handle to the open position while the system is pressurized. The requirement to manually open the valve in order to reinitiate the flow of gasoline was considered an important safety feature in that it would prevent gasoline from flowing into an unattended burner.

Performance. Early in the Kim Hae operation, the safety valve failed. One by one each of the valves leaked, sprayed gasoline, and was replaced by a spare safety valve which also failed. After a small fire was caused by a malfunctioning valve all safety valves were removed, and with Air Force official approval, brass adapters were installed on each burner which permitted direct flow of gasoline to the burner generator. An investigation is being conducted into the causes for the safety valve failure. An interim report on the subject is contained in Appendix K.

With the brass adapters, the tankless burner units performed well. More than 23,000 meals were served without a burner malfunction or safety problem occurring. Figure 36 is a photograph of a tankless burner unit equipped with the brass adapter. Figure 37 is a close-up photograph of a brass adapter.

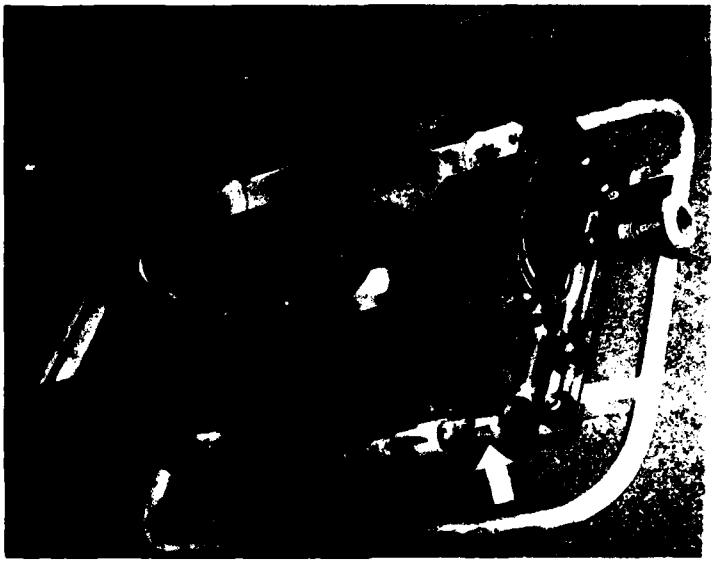

Figure 36. Tankless Burner Unit with Brass Fittings

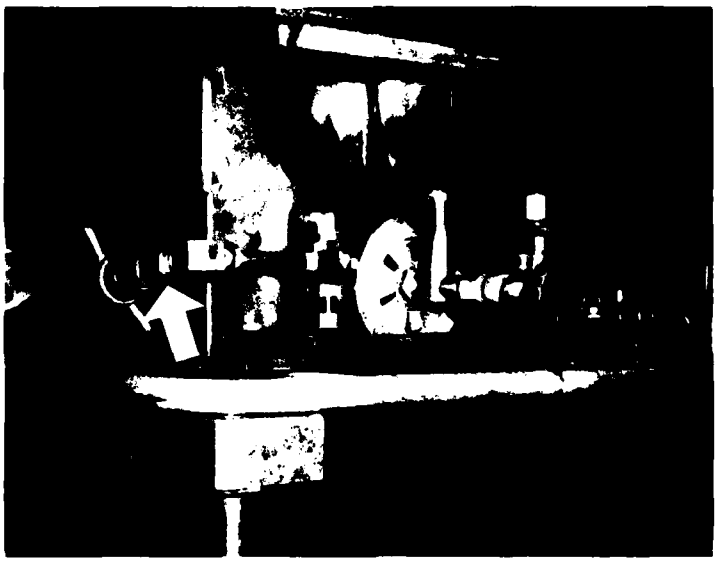

Figure 37. Close-up of a Brass Adapter

The remote site burner system was tested at the Kim Hae deployment and evaluated as a complete and highly valued success. The only problem of consequence was corrected early in the exercise, and the system operated reliably thereafter. When the safety valve failed, the foodservice superintendent was offered the choice of substituting M–2A burners for the tankless burners or keeping the tankless units equipped with brass adapters to replace the malfunctioning safety valve. He chose to retain the remote system believing it to be the safer and less labor intensive of the two systems. When asked for their evaluation of the burner system, 88% of the cooks said it was acceptable and 76% said it was better than the M–2A burner. When asked why they favored the remote tank burner system, the most frequently cited reasons were "no fuel" in the kitchen and no requirement to refill the burner units. Improved safety was also cited as a distinct advantage.

Problems associated with the burner system were minimal. In addition to the malfunctional safety valves, some cooks reported they did not like to handle the gasoline torch, and others found the preheater shut-off valve difficult to operate. An improved lighting arrangement, the need for an effective safety valve and an increased flow rate of gasoline to the burner are all items under investigation. In short, while refinements to the remote site burner system can be anticipated, the system has been tested twice in the field and has met design expectations. It is a low labor intensive system, it is free from the major hazard of the M–2A tank burner (the five gallons of gasoline), and it is energy efficient. The system is recommended for Air Force adoption.

Tables and Chairs

Table, Folding Legs, Wood Top, 72" (Item 42):

Description. The wood top table is designed for field use and is provided with a metal frame and metal tubular legs. The tubular legs fold in pairs. Its dimensions are width 30", length 72", and height 30". Additional table information is located in Table 11.

Performance. The 20 tables in the dining area were adequate for the number of diners at Kim Hae. At no time did customers wait for table space. Diner turn around time was about 20 minutes and those who had finished eating readily gave their chairs to others. Should an increased customer requirement occur, crowding could be eased by extending the meal hours and instituting the NLABS recommendation to offer a short order menu between major meals. The style and size of the tables are appropriate for field use and the tables are in the existing Harvest Eagle.

Table, Folding Legs, Wood Top, 36" (Item 43):

Description. The wood top table is designed for field use and provided with a metal frame and metal tubular legs. The tubular legs fold in pairs. Its dimensions are width 24", length 36", and height 27–1/2". Additional table information is located in Table 11.

Performance. NLABS recommendations prescribe three tables of this size: one for the store keeper, one for the superintendent, and one for the dining hall supervisor. If a headcount clerk is to be assigned, a fourth table is then required.

Chair, Folding Metal (Item 44):

Description. The chair is the front to back folding type and has a metal tubular type frame, metal seat, and metal back. Additional chair information is located in Table 11.

Performance. Six chairs were placed at each of the 20 tables. When every chair was occupied, the diners were quite close to each other, and some complained of overcrowding. Seldom, however, were all chairs occupied, and customers did not have to wait for unoccupied chairs. The chairs, which are in the Standard Harvest Eagle, are satisfactory for field use.

Utility Requirements

The obvious and important need to measure utility requirements at the Kim Hae field test was met by a variety of preplanned data collection activities. Analysis of the data indicates that the system does operate within the projected utility needs. It must be noted that the relatively low meal attendance rate had a confounding effect on calculations designed to project maximum system requirements; e.g., a higher meal attendance rate would require greater utility consumption.

Gasoline Consumption

A study of gasoline consumed by the burner system was completed at Kim Hae. Gasoline was delivered to the foodservice facility both in 55-gallon drums and by a tank truck used to fill the two 60-gallon remote tanks supplying the burner system. Considerable amounts of gasoline were used from the drums to fuel air heaters; some was used by other facilities at the exercise. On occasion, gasoline was siphoned from the drums to the remote tanks. The varied delivery modes and multiple uses of the fuel supply precluded a precise measure of gasoline consumed exclusively by the foodservice activity during the exercise. Given the above conditions, gasoline consumption was measured and expressed as gallons used per burner hour, and an average consumption rate of 1/4 gallon per burner hour is indicated. Additionally, it was planned to describe the ratio of burner hours to number and type of meals. A test design was constructed to cover a 24-hour period including four meals, that is, breakfast, lunch, supper, and midnight meal. Procedures were identified to measure gasoline consumption, number of burners used, and number of meals served. An AFESC representative assumed responsibility for collecting the data.

Test results are displayed in Table 12. However, data concerning fuel requirements for meal production were confounded by the use of electric-powered appliances in conjunction with burner-fired appliances. The AFESC investigator reported that shift leaders would not permit the exclusive use of fuel-fired equipment in meal preparation. Fear that the cooks would not be able to "keep up" with customer demand was cited as the reason for their decision.

The gasoline consumption figures derived at Team Spirit '81 indicate that the design requirement vis a vis the remote tank burner system as projected by NLABS was within acceptable limits. It was anticipated that two 60-gallon remote tanks would be sufficient to permit alternate day fuel deliveries during the maximum feeding period of an exercise accommodating 1100 troops. At Team Spirit '81, gasoline consumption was low enough to permit fuel delivery every third day.

Table 12

Gasoline Consumption Rate of Remote Tank Burners During Four Types of Meals*

Type	Meal	Headcount	No. and Location of Burner Units	Burner Hrs	Gasoline Consumption (US) (Gallons)	Gallons Gasoline Consumption Per Burner Hour
A-Ration	Midnight Breakfast	406	Griddles (2) Steam Table (1) Stock Pots (2)	44.55	10	.224
A-Ration	Lunch	331	Steam Tables (2) Griddles (2) Stock Pots (1) Ovens (3) Sanitation (1)	40.00	11.25	.281
T-Ration	Supper	288	Steam Table (2) Stock Pots (1) Sanitation (1)	15.00	3.8	.253
Totals		1,025		99.55	25.05	.2516 Gal (Average)

*Valid inferences regarding gasoline consumption by type meal are not possible from these data primarily because varying amounts of electricity were used at these meals. Type meals are referenced here only to described study characteristics.

Gasoline was also consumed by two 400,000 Btu air heaters (see Item 40 in Table 11) used to heat the 88' x 20' dining shelter. At least one heater was in constant use during the cold weather early in the exercise. The heaters were quite troublesome and apparently fuel inefficient. Rate of fuel consumption at full capacity was approximately two gallons per hour per heater. It was learned at Team Spirit '81 that one 400,000 Btu heater was sufficient to heat the large dining shelter when ambient temperatures ranged from 15°F to 50°F. Two heaters should, however, be included in each Harvest Eagle kit to avoid continuous running of one heater and to provide a backup in the event of heater problems. The best estimate of actual gasoline consumption by the foodservice facility during the 35 days of meal production is 950 gallons, including approximately 75 gallons used to fire the air heaters.

Electricity Consumption

During the first week of its operation at Team Spirit '81, the New Harvest Eagle food facility drew its electrical power from a single 60 kW generator (see Item 37 in Table 11). The NLABS project for electric requirement was under 60 kW; this estimate was validated at Kim Hae. Under the supervision of a Prime Beef electrician, generator readings were made while all electric appliances and lights in the system were turned on. The highest reading taken during the test showed only 67% (40 kW) of the generator's capacity was utilized. A single 60 kW generator supported the food system at Kim Hae; however, two 60 kW generators are recommended for the New Harvest Eagle to permit alternating their periods of service maintenance on a 24-hour on/off schedule. The food system was later wired into the Korean Air Base Primary electrical system. The electrical service panel (Figure 38 and Item 38) fabricated at NLABS was installed and wired by a Prime Beef electrician. No problems in the electrical system were reported.

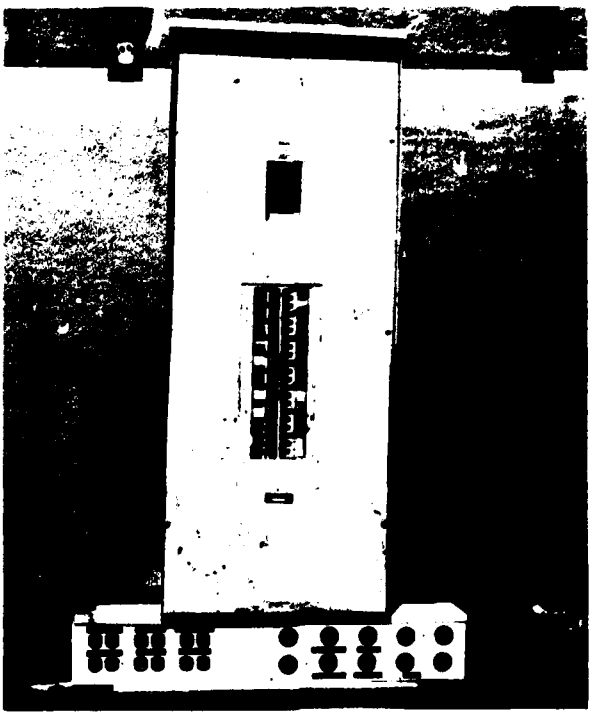

Figure 38. Electrical Service Panel

A series of power readings were made by the electricians; these are displayed in Table 13. Further testing of the maximum current requirement was done resulting in findings that further support the NLABS power estimate, i.e., a 60 kW maximum electrical requirement.

Table 13

A Sampling of Electrical Power (Amps) Readings at the Foodservice Complex at Team Spirit '81*

Time	12 March	13 March	15 March	16 March	17 March	18 March
1300	–	–	–	50	48	50
1315	–	–	–	53	53	53
1330	–	50	48	53	55	55
1345	–	55	52	10	9	10
1400	–	56	55	–	–	–
1415	–	10	9	–	–	–
1600	–	60	50	48	50	50
1615	–	68	53	52	53	52
1630	–	60	57	55	54	54
1645	–	7	10	10	10	10
1800	46	59	46	49	50	50
1815	75 **	30	52	52	52	53
1830	74	60	54	54	55	55
1845	24	22	11	10	10	10

*The readings were made by electricians, members of the Prime Beef engineer group who installed and maintained the electrical system at Kim Hae.

**The atypically high ampere readings for 12 March were a function of an all equipment on test under controlled conditions. This reading is equivalent to approximately 47 kW in a three-phase system.

Water Consumption

During the early days of the exercise, water was supplied to the foodservice complex through a 5/8" garden hose connected to a faucet located at a distance from the kitchen. Water in the hose froze on several occasions and other interruptions in the water supply system created problems for cooks who were forced to carry water in cook pots to the kitchen. Later, three water buffaloes were brought to the site and these proved to be satisfactory (see Figure 39). Eventually, a 2" plastic pipe was laid from a remote source to the foodservice area where a standpipe and connected hose fed water to the system.

Figure 39. Water Buffalo Used at the Kim Hae Test

While the water was being supplied to the foodservice facility from the water buffaloes, a study was made of daily water consumption. Table 14 displays the daily meter readings and gallons consumed. The water meter was checked and found accurate; however, cooks and others drew some water directly from the water buffaloes and this water was not registered by the meter. Further measures of water requirements for the New Harvest Eagle system are recommended to increase reliability of estimates of water in an arid operational environment.

Stringent water conservation measures were not implemented at the Kim Hae food facility. When water conservation is afforded an extremely high priority, practices can be effected which substantially reduce the water requirements; most obvious of these practices is the T-ration meal which can be prepared with no water and which requires minimum sanitation. The only substantial use of water in a T-ration menu is for beverage production.

Table 14

A Sample of Daily Water Consumption (in Gallons) by the New Harvest Eagle System at Team Spirit '81*

Daily Meter Readings**	Gallons Used
9 March/0022154	–
10 March/0022732	578
11 March/0023238	506
12 March/0023969	731
13 March/0024508	539
14 March/0024990	482
15 March/0025387	397
16 March/0025784	397
	3,630

Average Daily Consumption = 519 gallons

* Readings were made daily at 1500 hours.

** The water meter was tested for accuracy on two different days by an NLABS Engineer. The results indicated the meter was accurate within 2-1/2%.

The Field Menu

The menu served was basically the AFESC field feeding menu adapted to use T-rations for the supper meal. The first arrivals from NLABS to the site at Kim Hae handcarried a number of T-rations. On the day of arrival at Kim Hae, the advance party of Air Force Engineers was served T-rations which were heated in a stock pot with an M–2A burner underneath. Several T-ration meals were served in this manner during the site erection period. When the kitchen became operational, full menu service began.

Breakfast was served at 0500–0800 and offered eggs to order, breakfast meats, and hash brown potatoes from the potato extruder unit. Juice, cereal, and fruit were also available.

The noon meal consisted of two entrees, two vegetables, a starch, and two desserts. Beverages, salad, and bread accompanied the meal. Short order service was available infrequently and only during the dinner meal. When short order service was available, it was extremely popular with customers. Some T-rations were used at the noon meal intermittently where they added variety (e.g., chili and sloppy joe for short order) or where, on occasion, they acted as a substitute when otherwise an item such as vegetables would not have been served due to non-availability.

The evening meal was a T-ration meal. Table 15 lists the T-ration products that were shipped for Team Spirit '81.

To determine the number of tray packs required for a particular number of meals, NLABS had estimated that an entree tray would yield 12 servings, a starch tray 18 servings, a vegetable tray 24 servings, and a dessert tray 12 servings. At Team Spirit '81, some data were collected on servings per tray as displayed in Table 16.

In global terms, at least, the estimate of 12 servings from an entree tray pack is valid. The average of those measured was 13.65 servings. The vegetable tray estimate of 24 servings appears high since the average of those tracked was 19.35 servings. The starch estimate of 18 servings per tray is also valid as the average of the seven trays measured was 18.6 servings. The desserts provided at Team Spirit '81 consisted of a variety of fruit desserts and cherry nut cake. The fruit desserts were commercially available. The cherry nut cake was prepared and packaged at NLABS. The average serving of the eight trays of fruit was 20 servings per tray. The cherry nut cake yielded 60 servings per tray. Because of the wide range of servings per tray, a general statement about dessert servings per tray cannot be made. In estimating servings per tray, it is safe to say the entree will yield 12 servings and the vegetable and starch will yield 18 servings per tray, thus a ratio of 1.5 trays of vegetables and starches to one tray of entree exists. No particular portion control procedures were in effect when the measurements were made.

Milk was available in powdered form, and as indicated in the food acceptance data, this form of milk was acceptable to the customer. This substitution contributed significantly to the use of just three 150 cubic foot refrigerators in contrast to the normal 10 refrigerators used at similar Standard Harvest Eagle exercises. Other beverages served were a non-carbonated fruit flavored drink and coffee. Two five-pot coffee units each brewed one pot at a time, thus ensuring fresh coffee at all times.

Table 15

T-Rations Available at Team Spirit '81

Entrees	Vegetables	Starches	Desserts
Beef Ravioli	Whole Kernel Corn	Potatoes in Brine	Apple Compote
Beef Tip w/Brown Gravy	Green Beans	German Potato Salad	Blueberries
Sliced Roast Beef w/Brown Gravy	Lima Beans	Scalloped Potatoes w/Ham	Peaches
Roast Pork	Stewed Tomatoes		Cherries
Stuffed Cabbage	Sweet Peas		Cherry Nut Cake
Macaroni & Beef in Sauce			
Sloppy Joes			
Macaroni and Cheese			
Beef Stew			
Beef Stroganoff			
Chili con Carne			
Chicken ala King			
Chicken and Noodles			
Lasagna w/Meat Sauce			
Salisbury Steak			
Sliced Beef in BBQ Sauce			
Chicken Leg Cacciatore			
Stuffed Peppers			
Chicken Breasts			

Table 16

T-Ration Portion Measurements Made at Team Spirit '81

	No. Trays	Range	Average Portion Per Tray
Entree			
Salisbury Steak	3	19–23	21.0
Chicken Cacciatore	3	9–10	9.6
Cheese Ravioli	6	9–13	11.3
Macaroni & Cheese	12	15–21	18.9
Lasagna	3	12–14	12.6
Stuffed Peppers	3	12	12.0
Beef Stew	6	10–14	11.3
Chicken Ala King	6	11–15	12.5
Vegetables			
Corn	9	13–24	19.6
Green Beans	9	17–20	19.1
Starches			
Stew Cut Potatoes	3	22–23	22.6
Scalloped Potatoes	4	14–17	14.7
Desserts			
Peach Compote	7	12–16	14
Blueberry Compote	1*	25	25

*Only one container of Blueberry dessert was measured thus the portion number cited could be misleading.

Ground coffee was metered into filters from two dispensers that automatically controlled the coffee mix; thus, quality control was effected. A daily high volume coffee requirement to supply aircraft crews was accomplished without difficulty.

The GSA compartmented paper tray held its shape and form through all meal compositions and did not leak or otherwise separate during cutting of food products. No customer complaints concerning the tray were received.

The overall customer evaluation of the menu offered at Kim Hae was acceptable and compared favorably with food acceptance ratings at previous exercises.

Customer hedonic ratings of T-rations were compared with ratings of A-ration meals. Both A- and T-rations were rated quite high, i.e., 7.45 and 7.00, respectively, on a nine-point scale. (See Section on Customer/Worker Reaction for a detailed description of customer ratings.)

Nearly all cooks (96%) expressed acceptance of the daily T-ration meal and were positive regarding the increased quantity and quality of deep fried products, especially the Frispo-extruded potatoes, which the addition of new field equipment made possible. Cooks also gave high marks to the adequacy of the kitchen equipment to prepare the field menu.

The menu served from the New Harvest Eagle was clearly acceptable to both the customer and the cooks. The cooks favored the new system because it imposed no restrictions on choice of cooking method. The introduction of a deep fat fryer opened a whole new variety of foods that were not previously available. The Frispo-matic with very little effort produced a highly acceptable french fry product. The griddle also permitted greater diversity of products, especially those for breakfast, and for short order service. The tilt fry pan, a favored piece of equipment, added flexibility to food preparation and allowed for a quick response to customers' needs. The customers now have a menu that is virtually the same as they would find in their home base dining hall. The foodservice function is recognized to have an impact on morale. At peacetime exercises, this menu will contribute to a high level of morale.

The Training Program

The need for manager and worker training was observed and documented at Air Force exercises during the data collection phase of this study detailed in an earlier report. No systematic on the job training (OJT) for foodservice workers was observed at any exercise. Supervisors were found lacking in several skill areas. It was concluded and recommended to the Air Staff that training for managers and workers would improve system productivity and worker morale at field exercises. A contract was negotiated with A. D. Little, Inc., to provide assistance in designing training programs for field use. An OJT guide was received from A. D. Little and modified by NLABS for use at the Korean exercise. Also, an instruction manual was prepared by the contractor and after extensive revision by NLABS personnel it was readied for use overseas. The management training program was delivered too late for use in Korea; however, excerpts from the proposed management program are included in Appendix L of this report and in Section XIV in the Instructional Manual. Lastly, a videotape produced at the Eglin AFB prototype test was edited by NLABS and, with added voice narration, it was prepared for field use. Thus, the NLABS training package implemented at Team Spirit '81 included the following:

1. A videotape depicting complete food system assembly and erection.

2. An illustrated instructional manual describing shelter and equipment assembly and operation.

3. An On-The-Job Training Guide providing methodology for training and eventual certification of foodservice workers in the field (see Appendix M).

The videotape and other materials will be available for Air Force use should the New Harvest Eagle be adopted. Technical report Natick/TR–034 contains the instructional manual, the OJT program, and the guidelines for managers.

The NLABS position is that the optimum time for training foodservice workers at a field exercise is during the early phases when the customer demand is less and more time is available. When the exercise deployment reaches its maximum size, there is much less time for formal training, although even during this phase, person-to-person, i.e., cook-to-cook, training assistance is possible. Examples of this type of "peer" teaching was observed during the exercise.

Without benefit of scientifically controlled experimental design and results, the evaluation of the foodservice training program at Kim Hae must be based on information reported by cooks and supervisors and on observations of others relative to the effects, if any, of training on worker behavior.

The basic group of cooks consisted of 17 persons from five bases. They arrived at Kim Hae on 15 February 1981 and remained until the end of the exercise. Of this group, only two had prior field experience. A slightly more experienced group of seven cooks arrived at Kim Hae on 6–7 March 1981 and remained until the exercise ended.

The cooks were interviewed individually on a wide variety of subjects, including their opinion of the training program. Of the original 17 cooks, 13 felt the program was "good", and four rated it as "adequate". Of the late arriving group of seven, five received only part of the training, and two reported they had received no training. All cooks who saw the videotape rated it as "very helpful." Supervisors and workers commented favorably on the instructional manual. The group only partially trained at Kim Hae arrived when the exercise was reaching its maximum size. Also, they were of slightly higher rank as a group than the original cooks and seemed reluctant to ask for assistance from workers who were their subordinates.

The NLABS strategy for implementing the new training program was to train a small group of cooks at the prototype test at Eglin AFB. This group, trained on the New Harvest Eagle, would serve as a training cadre at the overseas evaluation. Five cooks from the Strategic Air Command were trained during the Eglin test but were not deployed to Kim Hae, Korea for Team Spirit '81. Instead, the senior training non-commissioned officer at the Eglin site served as the principal trainer of the foodservice superintendent and workers at the Kim Hae deployment. Due to a delayed arrival of cooks to Kim Hae and to a shortened stay by the senior trainer, the trainer was able to give minimal direct training to cooks, although he did succeed in giving extensive briefing to the superintendent. The superintendent served as the training supervisor throughout the exercise. The NLABS recommendation is that the dining hall supervisor, i.e., the second in command, should supervise the training program.

The OJT program strategy as applied to field training is to promote self-responsibility for learning and for helping others learn. An individual who is motivated to learn to operate equipment or perform tasks will seek assistance from someone who can teach him. When a worker has demonstrated to the training supervisor that he can perform as required, he is "checked off" by the supervisor. Then, the worker is encouraged to share his newly-acquired knowledge with others.

The principal function of the training supervisor is to motivate workers toward training and to check and certify their learning. The superintendent and shift leaders trained the workers at Kim Hae to operate the system. After 19 days on site, the superintendent reported that all but two of the early arrivals were fully trained and had been "checked off" by him.

In general, cooks had positive things to say about the training they received at Kim Hae. Indirectly, their comments on other items suggested they were well trained at the exercise. For example, 92% of the cooks said the equipment, most of which was new to them, was not difficult to operate and maintain.

Evidence of effective training was seen in the performance of the cooks. All cooks but one learned how to light the remote site burner system which required, among other tasks, the lighting and use of a gasoline torch and the exercise of considerable patience. The new automatic and manual potato extruders were operated by all cooks. The automatic was much preferred and used exclusively during the high level feeding period.

Also, it is valid to infer that training had a large effect on the perfect safety record in the foodservice operation. Not one accident was reported due to cook error. The only accident was a result of system failure when the safety valve in the burner system malfunctioned, causing a small gasoline fire which slightly burned the face of a cook who was attending to the burner unit. High intensity performance accompanied by a perfect record strongly suggest the operators were adequately trained in the relevant tasks.

In spite of a difficult situation, the initial training time of the Eglin senior trainer was shortened in which the superintendent instead of the recommended dining hall supervisor served as training leader, and the foodservice group was almost totally inexperienced in field feeding, the cooks learned to operate the New Harvest Eagle effectively and safely.

Comments praising the training aids and procedures were made by the foodservice group and by senior Air Force officers at Kim Hae. Their comments and the observed performance of the foodservice personnel indicated that the NLABS training methodology and materials were effective. The program should be further tested at exercises and revised as appropriate.

It is important that the position of dining hall supervisor be evaluated as a locus of training leadership. The foodservice superintendent should not assume the additional responsibility of monitoring the training program as was the case at Kim Hae. A course in training management could be a useful experience for personnel who are or who are about to become dining hall supervisors.

Administration/Record Keeping

A potential manpower savings was identified in the areas of subsistence and cash control. It was recognized that workload reductions could be realized by eliminating cash collections and by using an abbreviated accounting system at exercises and during the initial phase (30–60 days) of contingencies. The empirical evaluation of Air Force field feeding indicated administrative work comprised from .04% of the total productive foodservice time (Dawn Patrol 78) to 11.7% of the productive time at Brave Shield 18. Dawn Patrol 78 achieved these results by utilizing a test on an easier system not yet approved by the Air Force.

The NLABS recommendations proposed that foodservice at exercises should simulate, to the extent possible, the conditions of the early phase of a contingency where cash payment of meals probably would be eliminated. It was further recommended that the headcount clerk function be performed by a cook on the serving line who would tally the number of disposable trays dispensed, such headcount information being necessary for planning and cost/customer analysis.

A cashless meal accounting system designed by Air Force Engineering and Service people AFESC/DEHF and approved by Air Force Accounting and Finance Center was introduced at Team Spirit '81 (see Appendix N). The system did not eliminate the headcount clerk function and, indeed, required more administrative manhours than was recorded at four previous exercises. In fact, when the headcount manhours are added to the other administrative time spent, 15.6% of all productive labor by personnel assigned to the foodservice operation was spent on administrative tasks and 75% of the administrative workload was created by this "cashless" meal accounting system.

An abbreviated Subsistence Accounting System proposed by NLABS and designed by AFESC was also tested at Team Spirit '81. This system required fewer hours to administer than previous systems and met Air Force accounting requirements (see Appendix O). The experimental accounting system was accomplished using only .04% of the total productive time. The only comparable exercise vis a vis administrative manhours was Dawn Patrol 78 at which the accounting was streamlined and cash collection and headcount functions were eliminated. At Dawn Patrol, .07% of productive manhours was devoted to administrative tasks. Yet at Kim Hae, the new administrative system required proportionately fewer hours than even the Dawn Patrol System.

The NLABS recommendation to reduce the subsistence and cash control workload in the field was only partly implemented at the Team Spirit '81 field test. The subsistence control system implemented resulted in manpower savings. The cashless meal accounting system created an increased workload, and in view of the high Air Force priority assigned to manpower savings, the "cashless" system as it operated at Kim Hae cannot be recommended.

SYSTEM REFINEMENTS AND RECOMMENDATIONS

The primary objective of MSR USAF 9–1, "Design of USAF Mobility and Augmentation Foodservice System" was to define an Air Force mobility contingency foodservice system which would minimize foodservice personnel requirements while maintaining or exceeding present levels of cost benefits, particularly the level of customer acceptance.

To the extent findings derived from field tests at peacetime exercises apply to wartime requirements, the New Harvest Eagle field system as defined is an effective response to a high priority military need. With regard to its application to military exercises, the new system has fully demonstrated its acceptability to workers and customers and has confirmed its efficiency by demonstrating substantial manpower savings as compared with other field feeding systems. Even greater efficiency and commensurate manpower savings are projected where customer meal attendance rates are high and economies of scale can be expected to obtain and where all system requisites are met especially in the areas of management and training.

Based on field test results and relevant Air Force responses, it is recommended that the New Harvest Eagle be adopted for use in Air Force field feeding environments and that refinements be made to the system prior to its acquisition as indicated below.

THE SHELTER SYSTEM

- Fabric with increased water repellency and tear strength must replace present fabric.

- Vinyl coated polyester liner material is preferred over cotton duck material for kitchen liners.

- Aluminum bump through screen doors with plexiglass inserts are required for customer entrances and exits and for the workers' exit from the sanitation/storage shelter.

- Ventilation screens in the kitchen liner should be relocated for improved heat escape from griddle exhaust stacks.

- Frame securing pins should be lengthened by one inch and tapered to facilitate their alignment function.

- Field repair kits and spare parts must be procured and added to the system.

THE EQUIPMENT SYSTEM

- Present three-well, burner heated steamtables should be enlarged to four-well steamtables.

- Deep fat fryer capacity should be increased from present 90 pounds per hour to 125 pounds per hour.

- Both manual and automatic (electric) potato extruders should be included in each Foodservice Kit.

- A trash compactor is recommended for use at exercises only.

- An improved safety valve is required for the fuel lines of the remote site burner system.

- An improved preheater is needed for each individual burner unit.

- Dust caps must be attached to all disconnect valves (both male and female fittings).

- Satellite service panels should be added to the power system for use in the dining and sanitation/storage areas.

THE FIELD MENU

- The Frispomatic vitamin C fortified potato mix prepared for use in the Frispomatic potato extruders must be added to the ration lists of all major commands. The NSN for this potato mix is 8915–01–067–7966.

THE TRAINING PROGRAM

- The training program and how to use it should be included in the curricula of all Air Force foodservice training programs.

- A seminar-type program to train senior foodservice personnel as trainers should be designed and made available to them.

- Air Force policies and programs for selecting and training foodservice managers requires review and revision in view of observed management behavior. Guidelines in this area are offered in the Instructional Manual and in Appendix O of this report. Further, an Air Force requirement in management development is funded in the Department of Defense Food RDT& Eng Program for FY82, and it is anticipated that detailed recommendations for improved foodservice management will be forthcoming.

- A program leading to certification as field feeding expert should be developed and made available to foodservice personnel.

ADMINISTRATION/RECORD KEEPING

- A low labor-intensive system of meal accounting should be designed to eliminate cash collections from field exercises.

WATER DISTRIBUTION SYSTEM

- The water distribution system must be designed for use in environments where water freezes.*

*At the Korean field evaluation water lines froze repeatedly.

APPENDIX A

LETTER FROM USAF REPRESENTATIVE TO JOINT TECHNICAL STAFF DOD FOOD RDT&ENG PROGRAM

DRDNA-ZF 14 July 1980

SUBJECT: Letter of Appreciation

THRU: Mr. James H. Flanagan
Technical Director
US Army Natick Research and Development Command
Natick, Massachusetts 01760

TO: Dr. Robert J. Byrne
Chief, Operations Research and Systems Analysis Office
US Army Natick Research and Development Command
Natick, Massachusetts 01760

1. The Air Force Mobility and Augmentation Feeding System was recently given a pre-exercise shakedown at Eglin Air Force Base, Florida. The entire system functioned remarkably well, especially for a system assembled for the first time. Everything worked!

2. The Air Force was especially happy with the system. I wish to express appreciation to the NARADCOM team who participated in the Eglin pre-exercise test. In particular, the undersigned wishes to thank the Program Manager, Mr. Philip Brandler; the Principal Investigator, Dr. Eugene Nuss and the Operations Research Analyst, Mr. Joseph Wall of ORSA. Under their leadership, the team members, including key personnel of FSL, FEL and AMEL did a truly outstanding job.

3. Please convey my personal appreciation to everyone at NARADCOM who made this pre-exercise test so successful.

DON VAN DYKE
LtCol USAF
USAF Representative
Joint Technical Staff
DOD Food RDT& Eng Program

CF: CDR, NARADCOM
Mr. Brandler, ORSA
Dr. Nuss, ORSA
Mr. Wall, ORSA

APPENDIX B

CUSTOMER AND FOODSERVICE WORKER OPINION AT THE INITIAL FIELDING OF PROTOTYPE

CUSTOMER AND FOODSERVICE WORKER OPINION AT THE INITIAL FIELDING OF PROTOTYPE

In the initial fielding of the New Harvest Eagle Kitchen at Eglin AFB in June 1980, Behavioral Sciences Division, Food Sciences Laboratory, NARADCOM collected limited customer food acceptability data and data concerning food service worker opinion of the kitchen complex.

METHOD

Food acceptance interviewing of customers for tray pack meals was carried out by NARADCOM personnel on a one-to-one basis at tables in the dining tent with customers who had just finished, or were about to finish eating. Customers also completed a one page paper and pencil opinion survey concerning the field dining area at their tables after completing a mid-day (A ration) meal. Food service workers completed a paper and pencil survey in a group and were interviewed on a one-to-one basis.

CUSTOMER OPINION

Customer opinion of the New Harvest Eagle food service system was very favorable. Each of eleven aspects of the New Harvest Eagle system was rated higher than it had been in the three exercises using the Harvest Eagle. These data, and for that matter all of the New Harvest Eagle customer data, should be qualified by the fact that the customers were only in the field and eating in the system for three days. Nevertheless, ratings of the system were high.

Customers gave high ratings to the opportunity to sit with friends and service by dining facility personnel. In contrast to the relatively low rating by the Harvest Eagle customers, New Harvest Eagle customers also gave a high rating to speed of service. Again, however, this rating should be qualified

by the fact that there were only approximately 90 customers to be served at any meal. The food related variables were also rated high by New Harvest Eagle customers with food quantity being the lowest rated of quality, variety, and quantity.

The generally high ratings given the food in the opinion survey were reflected in the customer food acceptance ratings, which, in the Eglin New Harvest Eagle exercise were taken only on the evening tray pack meals. Of eight tray pack entrees, only one, Salisbury Steak received a mean rating below 7.00 on the traditional nine point hedonic scale. While ratings of tray pack starches were somewhat lower, only one, macaroni and cheese (5.94) fell below 6.00. The four vegetables served were all rated above 7.00, and only one dessert, orange nut cake (6.00) was rated below 7.00.

As a matter of fact, the only customer complaint came in response to questions concerning the temperature in the dining environment with the New Harvest Eagle customers being more concerned about the heat in the dining tent than the Harvest Eagle customers had been. Some of this difference is undoubtedly attributable to the relatively high ambient temperatures of Florida in late June. Whereas Harvest Eagle customers had complained about crowding in the eating area, New Eagle customers did not seem to be concerned about that (of course, there were approximately 90 customers).

FOOD SERVICE WORKER OPINION

The food service workers were asked to rate fourteen aspects of their field kitchen in a seven point scale format. On each of the fourteen characteristics, New Harvest Eagle cooks gave higher mean ratings than the cooks on the three Harvest Eagle exercises. With the exception of temperature, the New Harvest Eagle means were from one to two scale points higher than those for the Harvest Eagle. The biggest differences between the two (New Eagle being rated better) were in the areas of size of the kitchen, crowding of cooks, condition of equipment, amount of storage space, and ease of access to supplies.

The workspace aspect was followed up with a more detailed question. In Harvest Eagle, worker response had been extremely negative with the size of kitchens being rated at 1.33 (between much too little and somewhat too little workspace), 2.52, and 2.92 (between somewhat too little and slightly too little workspace). In the New Harvest Eagle, the mean response was 4.33 (a little bigger than just about the right size), expressing satisfaction with the size of the kitchen.

The only complaint the cooks had about the kitchen was the temperature, but even that rating was higher than the rating given kitchen temperature by the Harvest Eagle cooks.

Overall, those cooks who had worked in other field kitchens rated the New Harvest Eagle as being between somewhat better and much better (6.13 on a seven point scale) than those other field kitchens in which they had worked.

Food service worker interviews started with general open ended questions concerning the good and bad aspects of the New Harvest Eagle kitchen. The good aspects most frequently mentioned were the equipment (by 87% of the cooks), the burner system (62%), the temperature in the kitchen (62%), the workspace in the kitchen (50%), and having a separate, connected storeroom (50%). The most frequently mentioned bad aspects of the kitchen were the lip on the rear of the grille which was perceived as causing burns (62%), the handle to the grease trap plug on the grille which also was seen as causing burns (62%), and the doorway screens which half the cooks said were difficult to close.

A separate question about the serving line elicited positive overall comments from all cooks and the suggestion of adding one more steam well by 75% of them.

All cooks found the burner system to be adequate and 86% of those who had previously used the M-2 burner preferred the new burner system. Reasons given

for this preference were that it requires no filling of individual burners (100%), it was seen as safer (86%), and it was seen as burning cleaner (43%).

The cooks were concerned about the temperature in the kitchen. One quarter of the cooks interviewed felt that the temperature was too hot; half the cooks thought the temperature was better than other field kitchens they had cooked in, but still too hot; and the remaining quarter perceived the temperature as being acceptable.

The cooks all were enthusiastic about the storeroom and the sanitation area, although they agreed that the storeroom needed some sort of flooring.

HUMAN FACTORS

The size of the New Harvest Eagle kitchen and workspace layout were far superior to any kitchen previously observed in the field. The major human factors concern with the kitchen as currently configured is the temperature. While kitchen temperatures were better than those measured on exercises using the Harvest Eagle kitchen, they still were high enough to cause some concern and should be addressed. There were a few other minor human factors problems which can easily be remedied before further testing of the kitchen.

SUMMARY

Customer opinion of the New Harvest Eagle food service system was very favorable. Each characteristic of the modified system was rated higher than it had been in the Harvest Eagle system. Customer acceptance of the tray pack food items tested was generally very high.

Worker (cook) opinion was also very high with each characteristic again being rated higher than it had been by Harvest Eagle cooks. From the human factors point of view, the New Harvest Eagle was superior to kitchens previously observed in the field.

TABLE B-1

Foodservice Worker Ratings of Kitchen Workspace

	Much Too Little	Somewhat Too Little	Slightly Too Little	Just Right		Much Too Much	
	1	2	3	4	//	7	
New Harvest Eagle (Eglin AFB)				XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX (4.33)			N = 9
Harvest Eagle (Team Spirit 78) Korea				XXXXXXXXXXXXXXXXXX (2.92)			N = 13
Harvest Eagle (Brave Shield 17) Nellis AFB				XXXXXXXXXXXXXXX (2.52)			N = 31
Harvest Eagle (Dawn Patrol) Italy				XXX (1.33)			N = 15

TABLE B-2

Mean Customer Food Acceptance Ratings of Tray Pack Items — Eglin AFB

ITEM	N	MEAN
ENTREES		
Chicken Cacciatore	17	7.76
Beef Burgundy	24	7.62
Lasagna	28	7.54
Roast Pork	29	7.41
Sliced Roast Beef	30	7.27
Braised Beef Tips	23	7.22
Sliced Turkey	18	7.22
Salisbury Steak	28	6.43
STARCHES		
Scalloped Potatoes with Ham	70	6.96
Cut Potatoes	48	6.92
German Potato Salad	34	6.29
Macaroni and Cheese	33	5.94
VEGETABLES		
Lima Beans	17	8.00
Corn	40	7.42
Peas	51	7.35
Cut Green Beans	55	6.27
DESSERTS		
Apple Dessert	35	8.02
Cherry Dessert	29	7.86
Blueberry Compote	6	7.50
Orange Nut Cake	5	6.00

TABLE B-3

Mean Customer Ratings of Eleven Aspects of Air Force Field Foodservice

	Harvest Eagle N = 312	New Harvest Eagle N = 82
a. Chance to Sit With Friends	5.94 (1)	6.43 (1)
b. Service by Dining Facility Personnel	5.76 (2)	6.42 (2)
c. Speed of Service or Lines	4.18 (11)	6.25 (3)
d. Cleanliness	5.04 (6)	6.09 (4)
e. Quality of Food	5.64 (3)	6.03 (5)
f. Variety of Food	5.40 (5)	6.01 (6)
g. Quantity of Food	5.42 (4)	5.81 (7)
h. General Environment	4.63 (8)	5.71 (8)
i. Military Atmosphere	4.62 (9)	5.59 (9)
j. Hours of Operation	4.89 (7)	5.42 (10)
k. Monotony of Same Facility	4.34 (10)	5.21 (11)

Scale: 1 - Very Bad; 2 - Moderately Bad; 3 - Slightly Bad; 4 - Neither Bad nor Good; 5 - Slightly Good; 6 - Moderately Good; 7 - Very Good.

( ) Paper to rank order of rating

TABLE B-4

Mean Customer Description of the Dining Area of Two Field Feeding Systems

	Harvest Eagle N = 312	New Harvest Eagle N = 82
a. Too Cold	2.34 (2) *	1.21 (1)
b. Too Crowded	3.18 (4)	2.19 (2)
c. Too Noisy	2.19 (1)	2.23 (3)
d. Too Hot	2.91 (3) *	3.23 (4)

* Eliminating Korean Cold Weather Exercise.

Scale: 1 - Almost Never; 2 - Not Often; 3 - Sometimes; 4 - Often; 5 - Almost Always.

( ) Rank order of ratings

TABLE B-5

Mean Foodservice Worker Ratings of the Present Status of Two Field Kitchens

	(3 Exercises) Harvest Eagle N = 59	Harvest Eagle N = 9
a. Condition of Equipment	4.52	6.44 (1)
b. Amount of Storage Space	3.59	6.11 (2.5)
c. Ease of Access to Supplies	4.04	6.11 (2.5)
d. Ease of Food Preparation	5.04	6.00 (4)
e. Ease of Cleaning Up	4.38	5.77 (5)
f. Speed of Service	4.11	5.67 (6)
g. Size of Kitchen	3.18	5.55 (7.5)
h. Noise	3.99	5.55 (7.5)
i. Lighting	3.76	5.33 (9)
j. Crowding of Cooks	3.06	5.22 (10.5)
k. Ease of Serving Customer	4.20	5.22 (10.5)
l. Ease of Setting Up Kitchen	3.72	4.88 (12)
m. Ease of Moving Kitchen	3.53	4.50 (13)
n. Temperature	2.37	3.00 (14)
OVERALL	4.20	6.55

Scale: 7 - Very Good; 6 - Moderately Good; 5 - Slightly Good; 4 - Neither Bad nor Good; 3 - Slightly Bad; 2 - Moderately Bad; 1 - Very Good

( ) Rank order of ratings

APPENDIX C

SAFETY STATEMENT AUTHORIZING REMOTE BURNER SYSTEM OPERATION IN KOREA

XXXXXXLABORATORIES

DRDNA-ZSS 11 February 1981

SUBJECT: Safety During Testing of the USAF Experimental Remote Tank Burner System

TFRU: USAF Rep/JTS
DOD/Food RDT&Eng Program
US Army Natick Research and Development Laboratories
Natick, MA 01760

TO: US Air Force Inspection Safety Center/SEG
Norton AFB
California 92409

1. Reference letter, DRDNA-ZSS, 29 July 1980, subject as above.

2. The US Army Natick Research and Development Laboratories (NLABS) Safety Office has evaluated the USAF Experimental Remote Tank Burner System and believes that the system in its present configuration is safe for testing by both NLABS and USAF personnel, provided that operating instructions are closely followed. Changes in the system since July 1980 have eliminated the chance of an inadvertent fuel spill described in Reference 1. USAF operator (test) personnel should observe the system in operation by NLABS personnel prior to receiving detailed instructions on its operation, and all copies of the draft Procedural Training Manual should be annotated on Page V-11 with the underlined statement following in Paragraph 5.

3. Inclosed is Interim Safety Statement for Remote Tank Burner System, dated January 1981, which supersedes both the statement dated June 1980 and the addendum dated 26 June 1980. The present Interim Safety Statement has two inclosures--a June 1980 Interim Technical Report from Factory Mutual Research and a section from the draft of the Procedural Training Manual.

4. The Factory Mutual Report is based on an earlier version of the Experimental Remote Tank Burner System. Since that report, the system has been changed: The "safety valve" described in the Procedural Training

[illegible]-[illegible] 11 February 1981
SUBJECT: Safety During Testing of the USAF Experimental Remote Tank Burner System

Manual was added: the "excessive valving" mentioned in the Factory Mutual Report was eliminated; and different quick-disconnect valves were incorporated. The final Factory Mutual Technical Report should be based on a current system.

5. The section from the draft Procedural Training Manual should be supplemented with the following comments:

On Page V-11, the procedure for opening the safety valve is described before the statement, "Check to insure that both the preheater needle valve and the flame control valve are closed...."

Both the preheater needle valve and the flame control valve should be closed before the safety valve is opened.

6. Environmental Impact Assessment. A conscientious mental evaluation of the environmental consequences of the test in connection with the 1981 Team Spirit Exercise was conducted, and it is concluded that this test will have no adverse effect on the environment.

FOR THE COMMANDER:

1 Incl
as

THOMAS C. MARTIN, III
Safety Director/Radiation
Protection Officer

CF:

Mr. Morrisson/phd/2750

AFESC/DEFA Fire Protection
Tyndall AFB, Florida 32403

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Staff Reading File (w/o Incl)*
Deputy Commander/Executive Ofcr (w/o Incl)*
C, ORSA, ATTN: Dr. Brandler (w/Incl)
D, FEL (w/o Incl)
ATTN: John Perry
Act. Spec. Asst., DOD Food Program (w/o Incl)
*Inclosure is available in Safety Ofc if desired for reference.

2

Jan 1981
Supercedes
June 1980
w/Addendum 26 Jun 80

INTERIM SAFETY STATEMENT

FOR REMOTE TANK BURNER SYSTEM

1. Introduction

Purpose of Safety Statement. To enable NLABS and the US Air Force Engineering and Services Center to conduct preliminary field testing of the Modified Harvest Eagle Field Feeding System of which the Remote Tank Burner System is a component.

2. System Description

A. Purpose and Intended Use of Item

The Remote Tank Burner System is intended to be used with a field kitchen to provide heat for cooking and baking and to maintain heat for dish sanitizing as a component of the Modified Harvest Eagle Field Feeding System.

B. Background Information

This new burner design is similar to the Army's M2 Burner except it does not have a built-in gasoline tank. It is being tested for increased safety and evaluated for reduced labor requirements for the Harvest Eagle food service operation. This new approach allows for remote refueling of burners on a reduced schedule.

C. Item Description

A description of the system is included in reference 6B.

3. System Operation

Complete system operational instructions are included in reference 6B.

4. Safety Engineering

A. System Safety Data

The system safety data is included in reference 6A.

B. System Analysis and Test

Additional system test data and observations will be collected during NLABS' field testing.

(1) The probability of occurrence and effect of hazardous events on system operation and mission performance are given in Table IV of reference 6A.

(2) The hazard levels as established in MIL STD 882A and relation to program mission are listed in Table I in reference 6A.

(3) The analysis of system hazards are shown in the Fault Tree Analysis of reference 6A.

5. Conclusions and Recommendations

A. The system is considered safe for testing provided installation and operating instructions are followed and further that intensive instruction be given to the operators prior to initiation of system operation.

B. Potential hazards have been identified and precautions set forth as listed below:

(1) Fire extenguishers with fire protection rating of 10 ABC shall be maintained as follows:

(a) 1 each at Kitchen entrance

(b) 1 each at Sanitation Center entrance

(c) 1 each in Kitchen working area

(d) 1 each in Sanitation Center working area

(e) 1 each in burner lighting area

(2) No equipment using burner units may be placed in front of electric panel access.

(3) All fuel lines must be secured/covered against tripping hazards and all line connections must be visible.

(4) All valves on burners must be off when making or breaking quick disconnect fittings. Care must be taken to assure quick disconnects are aligned when connecting fittings. CAUTION! GASOLINE DRIP CAN BE ISSUED WHEN FITTINGS ARE CONNECTED OR DISCONNECTED. IF A FLAME IS CLOSE TO THE DRIP IT CAN IGNITE. EXTREME CARE MUST BE EXERCISED IN USING QUICK DISCONNECTS.

(5) Formulate a training procedure for fighting fire or fuel leak from fuel tanks. Personnel must remain away from spraying fuel if valving fails or breaks away from fuel tank while in operation (fuel will be under approximately 15 PSI of pressure). Air line must be disconnected at air tank located away from fuel tank to reduce fuel tank pressure if spraying fuel is encountered due to valve failure or break at fuel tank.

Associated hazards of this system are categorized in Table I of reference 6A.

The fuel tanks must be sand bagged to protect personnel and equipment in area against the possibility of a boiling liquid expanding vapor explosion (BLEVE), which could occur if fire surrounds the fuel tank. Caution must be stressed if a fuel line or quick disconnect leaks.

6. References

A. US Air Force Experimental Burner System: Fault-Tree Analysis and Hazard Comparison to US Army M-2 Burner, June 1980 by Factory Mutual Research Corp., Interim Technical Report, FMRC J. I. OEON9.RG, RC-79-T-74. (Inclosure 1)

B. Procedural Training Manual, Section D, Tankless Burner System (Inclosure 2)

APPENDIX D

LETTER FROM USAF HOSPITAL, ENGLAND (TAC) REGARDING THE MODIFIED HARVEST EAGLE FIELD KITCHEN

DEPARTMENT OF THE AIR FORCE
USAF HOSPITAL ENGLAND (TAC)
ENGLAND AIR FORCE BASE, LOUISIANA 71301

REPLY TO ATTN OF: 23 TAC HOSPITAL/SGV

SUBJECT: Modified Harvest Eagle Field Kitchen

TO: TAC/SGV

1. The Modified Harvest Eagle Field Kitchen was evaluated on 30 June 80. Lt. Col VanDyke and TSgt Awalt demonstrated the various features of the prototype and explained proposed modifications. Various aspects of the field kitchen were discussed with Dr. Nuss. A review of operations was presented by Dr. Nuss on 1 July 80. This facility can be erected by four men, has an estimated feeding capacity of 1100 and is expected to be transported on seven pallets.

2. Design Features

a. The new prototype combines the entire feeding operation into a single complex as illustrated on Atch 1. All tents may be extended by adding additional sections. The framework is tubular steel and the fabric is synthetic impregnated with plastic. High use entrances and passageways between tents are covered. All tents have a double ceiling design which allows air flow for cooling. Inner ceilings have screened vents to allow heat loss.

b. The flow pattern is excellent. Personnel enter through the dining tent, are served in the kitchen and return to the dining area through separate passages. This eliminates the need for a serving tent, saves time and manpower by serving and preparing food in the same area, and eliminates the possibility of contamination and temperature fluctuation while transporting food from tent to tent. This also eliminates high use entrances which may allow introduction of filth into the food handling area.

c. All entrances are equipped with synthetic screening to preclude entrance of insects.

d. The kitchen area has a white liner for additional insulation with vents strategically placed over the serving line. Two fabrics were tested. One was cotton duck similar to that used in medical tents and the other was synthetic material similar to the outer shell. Both materials are washable but the plastic can be washed in place.

e. Synthetic floors are used in the kitchen. It appears to be durable and easily cleaned. The dining tent and storage tent are floored with existing materials.

f. Heat for the dining tent is provided by a central unit with flexible ducts opening at intervals along the tent at ground level.

3. Design Recommendations/Comments

a. All covered entrances should have screening at both ends of the passage to provide a double barrier to insects.

b. A 90° turn in the main entrance passage would decrease the influx of dust into the dining area during high winds. This would not be necessary at exits as personnel can be instructed to exit and downwind side of the tent.

c. The plastic kitchen liner is more practical than the duck liner since field conditions may not permit removal and laundering of the duck liner.

d. Plastic covers for ceiling vents would be useful during periods of high wind to keep cold or dust out.

e. With the introduction of the new "tray" rations and freeze dried potatoes, refrigeration requirements have been greatly reduced. Opening the refrigeration units into the storage tent or covered passage would be desireable if feasible.

f. On loose dry soils forced air heating may create dust in the dining tent. Perhaps a flap or vent could be attached to direct air flow upward away from the floor.

4. Equipment Features

a. Grills and steam tables serve a dual function of preparation and serving. The heat source is a portable gasoline heater similar to the M-2 unit but with a remote fuel source. With minor safety modifications on the grill this system will be excellent. Maintaining safe food temperatures should be no problem.

b. Ovens have double walls for even heat distribution. This will insure adequate temperatures are reached throughout the product and make it more safe and palatable.

c. Cookers designed to accommodate large removable pots will allow cooking and serving from the same container.

d. Electrically heated cabinets are provided for preparing and holding hot foods at safe temperatures. They will hold a large number of pans or tray rations.

e. The use of freeze dried potatoes is an excellent idea. The equipment for rehydration and formation of the desired product occupies very little space. The end product is reported to be highly palatable and cooks are pleased with the ease of handling and storing the packaged granulated potatoes. This eliminated the problems associated with receiving and maintaining frozen potatoes under field conditions.

f. A single compartment sink with hot and cold running water is available in the kitchen for handwashing. A three compartment sink with attached scraping table is provided in the storage tent for cleaning and sanitizing utensils and pots and pans. Hot water is generated by a remote water heater capable of producing 190°F water in a few minutes.

Sanitizing temperatures are maintained with the same type of gas heating unit as other equipment. These sinks with a hot water source are the most significant improvement in sanitation.

5. Equipment Recommendations/Comments:

a. Although serving line equipment isn't equipped with sneeze guards, I do not think they are necessary in a field situation if adequate food temperatures are maintained.

b. If the sink in the kitchen area is used for salad preparation, a fenestrated insert which can be removed and sanitized should be used.

c. The kitchen is designed to produce a safe and palatable meal with a minimum of time and manpower and without electrical power if necessary. I am very impressed with this capability.

6. This prototype represents a significant advance in field feeding facilities over previous units. With the projected modifications it will be the closest thing possible to a fixed facility in sanitation, safety and operation. I highly recommend replacement of current outdated facilities with the Modified Harvest Eagle Field Kitchen. Slides of this unit will be forwarded as soon as available.

John D. Johnson

JOHN D. JOHNSON, Capt, USAF, BSC
Chief, Veterinary Services

1 Atch
Diagram of Kitchen

Cy to: NARADCOM/DRDNA-O
AFESC/DEHF

APPENDIX E

LETTER FROM US ARMY ENVIRONMENTAL HYGIENE AGENCY – ABERDEEN PROVING GROUNDS, MD, EVALUATING THE FIELD FEEDING SYSTEM

INDUSTRIAL HYGIENE DIVISION
US ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MD 21010

HSE-OI-H

02 JAN 1981

SUBJECT: Evaluation of Field Feeding System, Prime Beef Training

Commander
USA Natick Research and Development Command
ATTN: Gene Knus
Natick, MA 01760

Dear Sir:

Attached are comments and recommendations referencing my visit to Prime Beef Field Training Center, Field Feeding System at Eglin Air Force Base.

The Field Feeding System as observed was excellent. Your staff is to be congratulated on the fine work done in design and construction of this Field Feeding System. Much of the equipment is Air Force Specific, but the information obtained on site will be of great value in Army Field Feeding.

Sincerely,

THOMAS J. MCNEIL
MAJ, MSC
Chief, Sanitation and Hygiene Section
Industrial Hygiene Division

1 Enclosure
As stated

Copies Furnished:
Cdr, Tyndall AFB (AFESC-DEHF/Rodger Mervin)
Cdr, Tyndall AFB (AFESC-DEOT/MAJ Tull)
Cdr, Eglin AFB (AFESC/CMS Catlett)

OPERATION PRIME BEEF

FIELD FEEDING SYSTEM

1. Modified Field Grill.

a. Grill is a special design even-heating reversible grill. Grill has raised lip approximately 2 inches thick that prevents full use of grill surface without possible burn hazard to cooks.

Recommend - If feasible, reduce height of lip to allow full use of grill surface.

b. Grill vent stack gets extremely hot, possible burn hazard.

Recommend - Use of warning label on stack to indicate possible burn hazard.

c. Lack of quick disconnect or cut off switch at the main manifold to the individual burner units. The food service personnel requested quick disconnect and/or shut off capability at the manifold. I could see that considerable time could be lost in the event of fire in reaching the fuel reservoir.

d. Location of food scraper ports medially at front and back of grill apparantly causes problems because the ports act as a hot air draft and are difficult to work with.

Recommend - Scraper ports be moved to either end of grill. This would limit exposure of food service personnel to direct hot air.

e. Possible build up of carbon and other compounds on bottom of reversible grills. The grill is reversible.

Recommend - If not done previously, consideration be given to possible build up of toxic compounds on bottom of grill. Will standard cleaning remove build up. Are ther any reactions between grill surface and exhaust gases.

2. Serving Line - two queries were received.

a. First, if the current three compartments hot food line could be expanded to four compartments? This would assist in serving because the entree would not have to be replaced, and the line slowed us down often.

b. Second, There is no cold food line. I realize the kitchen was designed to serve only "T" rations, but with refrigeration capability a cold food line at least a small counter may be appropriate.

3. Equipment general.

Operation Prime Beef, Field Feeding System

a. Food service personnel expressed opinion that several pieces of equipment were too small specifically the potato extruder and the deep fat fryer.

b. Problems were noted with the fluorescent lighting which turn off "automatically?" when they get warm. Apparently this undesired shuting off of lights is a frequent problem.

Recommend - Possible use of conventional lighting as back up to fluorescent lights.

4. Tentage.

a. Leakage noted during rainfall at attachment of vestible section to main tent. I could not determine if this was an equipment or an installation problem.

b. Plastic window guard is located between the canvas flap and the window screen. In event of rain, the cooks have to go outside to roll down the flaps.

Recommend - If it will not cause a leak problem, placing the plastic window guard on the inside of the screen. This would allow easier closing in wet and/or cold weather.

5. Vinyl Flooring. Several food service personnel commented that the vinyl floor became very slippery when wet and that it burned easily.

6. Summary. I again want to express my opinion that you have done an excellent job in designing this field kitchen.

APPENDIX F

LETTER FROM NLABS TO HEADQUARTERS PACIFIC AIR FORCES, REGARDING RELEVANT FACTORS IN TESTING THE MODIFIED HARVEST EAGLE

DRDNA-O 8 December 1980

SUBJECT: Relevant Factors in Testing the Modified Harvest Eagle

Headquarters, Pacific Air Forces
ATTN: DEHS
Hickam AFB, HI 96853

1. The following describes certain major elements of the Modified Harvest Eagle (MHE) system prototype and identifies significant requisites to its successful operation and evaluation during the upcoming test activity. The system, which is in its prototype evaluation phase, is subject to modification based upon field experience. Therefore, accommodation within acceptable limits is probable and desirable, even though "certain" constraining conditions must be met to adequately test the system. Please keep in mind that the primary objective of the system design is to minimize the food service manpower requirement for contingency/wartime field feeding.

2. We believe the MHE is exceptionally efficient, and anticipate high productivity at its overseas test. It may well be that the stringent controls imposed on the system during its field evaluation regarding staffing, menu, ware, etc., to closely simulate actual contingency conditions will not be implemented during future exercises, however, it is essential that these controls be imposed during this evaluation so that manpower projections for wartime feeding can be validated.

3. During the past three years we have worked with Air Force personnel in the field and received the highest level cooperation one could hope for. We know the planned test will receive enthusiastic support from troops when the purpose and importance of the project are known to them. To this end, we offer the following detailed description, and suggest that a briefing on the prototype system be planned for those present at the test.

a. Readiness

The MHE will be capable of serving hot meals sooner after arrival on site than the projected 10 days of MRE's the AFSO field menu recommends

would imply. Hot T-ration meals can be offered from the MHE system two days after arrival on site given the availability of at least five personnel for shelter erection, and fuel and/or electricity for appliance operation.

b. Menu/Service Concept

At full or near-full troop deployment size, the meal concept for system evaluation is as follows:

Breakfast	2 Serving Lines - Full Service
Late Morning (if useful)	1 Serving Line - Short Order
Dinner	1 Serving Line - Full Service
	1 Serving Line - Short Order
Afternoon (if useful)	1 Serving Line - Short Order
Supper	2 Serving Lines - T-Rations Only*
Night Meal	1 Serving Line - (As preferred)

*T-ration meals include a supplementary beverage and bread, but do not include a salad, or non-T-ration desserts.

Keep in mind that changes can and will be effected where exercise conditions require. To reduce refrigeration requirements, certain food products are mandatory including reconstituted milk and a dehydrated potato mix for extruded fried potatoes. The dehydrated potato mix is a specially prepared one procured by NLABS and which has been shipped with the system. A copy of the complete T-ration order is inclosed (Inclosure 1). The scheduling of these items for daily meals can be easily rearranged as on site preference dictates. T-ration items which we feel have special application to the short order menu are Sloppy Joe, Chili Con Carne, Ravioli, Baked Beans, and German Potato Salad.

c. Equipment in the MHE should present no particular difficulty to cooks, even though much of it is either new field feeding equipment or modified models of older equipment. (Please see Inclosure 2, Equipment Inventory List.) It should be noted that a number of items must still be secured to fill out the equipment/utensil/furniture complement. These should come from Part D of TA 156 of the Harvest Eagle MRE kit. In fact, we recommend that a complete food service component from the MRE kit be brought to the exercise site for easy access to needed items. The MRE shelter system will not be needed, so this might safely be omitted.

d. Ware will be exclusively of the disposable type. Compartmented trays will accompany the system, having been procured by NLABS. Disposable flatware, cups, and bowls, must, however, be provided through normal Air Force exercise procurement procedures.

e. A new sanitation system is provided which includes a sanitation shelter, a hot water heater dedicated exclusively to the food service system, and three sinks and drainboards including a sanitizing sink with a burner to maintain sani temperatures. When tested at Eglin AFB, the sani system proved to work well and, coupled with the disposable ware and T-ration self-serving trays, significantly reduced productive time required to complete sanitation tasks. In fact, the supper meal requires hardly any sanitation labor at all!

f. The rostering of food service attendants or KP's is an undecided issue in the Air Force. At least officially, in wartime KP's would not be rostered. At exercise Team Spirit 78 we saw no rostered KP's. The Modified Harvest Eagle requires a very minimum of cleaning and sanitizing. We recommend that KP's not be rostered during the entire time the new system operates. It is mandatory that during the high feeding period, when productivity data will be collected (approximately 2 weeks), no KP's be assigned to the food service activity. This requirement relates to the Air Force need to predict as accurately as possible the MHE productivity level under the duress of wartime operations when KP's may not be available.

g. The manning formula will be validated during the exercise and adjustments in the size and work schedule of the work force may be required. Based on deployment size and anticipated attendance rates, our manning formula projects 17 food service persons will be required during the maximum feeding period. However, we recommend eight supernumeraries be deployed in the event productivity projections are inaccurate, or that something should occur which requires more cooks than can be anticipated. Excess cooks can participate in training or other profitable activities. A suggested work shift schedule is attached (Inclosure 3). It is understood that it may be adjusted to accommodate exercise conditions.

h. The prototype system is designed to function with three walk-in reefers. We recommend four be assigned to the system for test purposes in the event a backup reefer is needed. These reefers must also be provided from Air Force Harvest Eagle inventories.

i. A training manual is being published and will be used to train food service people in the erection, assembly, and operation of the system, as well as to serve as a continuous reference source on these procedures. Also, a video tape has been produced which presents the background and development of the project, and shows Air Force personnel erecting and operating the prototype. If a video tape recorder can be made available at the test site, the video tape can be used to good advantage as a briefing/training aid. Please advise if a video tape recorder (and TV monitor) can be made available on site.

A recommendation was made by MAJCOM and accepted by the Air Staff that food service personnel be provided a training program for use at field exercises and that field staffing guidelines include a training supervisor position. We suggest that the dining hall supervisor should also function

as the training supervisor and that time be made available to him to conduct OJT and to certify food service personnel as qualified in field feeding. Obviously, this is a new concept that will require testing and subsequent adjustments, however, the dining hall supervisor is tasked with the training function in the staffing guidelines inclosed (Inclosure 3). Additional guidance in training will be offered at the test activity.

j. Data will be collected throughout the entire operational period, however, the critical period for data collection is during the high feeding phase when productivity levels will be measured. Other data to be collected include: worker attitudes, customer acceptance, human engineering factors, fuel consumption, water consumption, customer flow-through rates, air temperatures (kitchen and dining areas), and other operational characteristics.

k. The inclosed photo (Inclosure 4) shows the MHE shelter as it was configured during its feasibility test at Eglin AFB. It is assumed the same configuration will be used at the overseas test. The diagram of the shelter layout (Inclosure 5) is included here simply to illustrate the type guidance provided in the training manual as well as to provide site preparation guidance to your engineers.

4. If there are additional topics or questions which need to be addressed prior to our arrival at the test site, please let Dr. Nuss hear from you. This letter should not be construed as prescription, rather, it is intended to offer a framework of guidelines within which there is opportunity for accommodation. As discussed in your telecon with Dr. Nuss of 1 December 1980, copies of this letter and inclosures should be provided by DEHS to relevant food service people.

5 Incls.
as

PHILIP BRANDLER
Program Manager
Operations Research and
Systems Analysis Office

CF:
AFESC, ATTN: DEHF

APPENDIX G

LETTER FROM COLONEL ROBERT R. REINING, JR., DCS ENGINEERING AND SERVICES, PACAF HEADQUARTERS, REGARDING THE NEW HARVEST EAGLE PERFORMANCE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS PACIFIC AIR FORCES
HICKAM AIR FORCE BASE, HAWAII 96853

6 MAY 1981

Mr. Philip Brandler, Program Manager
US Army Natick Research and Development Command
Natick, Massachusetts 01760

Dear Mr. Brandler

The Modified Harvest Eagle (MHE) met and in many instances exceeded our field feeding requirements at Kimhae AB Korea. Please thank Dr. Gene Nuss and members of the evaluation team. Their efforts contributed significantly to the success of the exercise.

My assessment of the system is from the user's perspective, based on feedback received from exercise participants, and I hope useful to your overall evaluation. I've also attached an after-action report from the veterinarians (Atch 1).

Tray-pack rations (T-rations) proved to be acceptable in terms of variety and palatability. T-rations were easy to store, handle and prepare. However, field personnel indicated that empty T-ration containers presented a trash problem due to bulkiness and numbers of containers. Also, the number of servings per T-ration was too low and a larger container (deeper) may be a solution, except for the trash problem.

Kitchen equipment, its layout and shelter design were a tremendous improvement over previous field kitchen operations.

The centrally fueled M-2 burners eliminated the need for constant monitoring of the units for pressure build-ups. The M-2 burners caused a fire when fuel leaked from one of the safety valves. The problem was corrected, and further testing of the valve system is required to eliminate any safety hazard. The burners were not able to heat the ovens to the required temperatures extending cooking times for roasts and preventing the baking of pastry products.

Running hot water to the kitchen is a significant improvement over the use of immersion heaters to wash and sanitize pots and pans. Personal and kitchen sanitation was greatly enhanced with the availability of a wash sink with running hot water.

The shelter system requires some modification to improve its water proofing and strength. A similar shelter system is being considered by the surgeons for field hospital use. The shelter design itself was excellent and easy

to erect and break down. The use of Herman Nelson heaters increased the availability of space in the system; however, numerous problems were encountered with the heaters.

Although there were some minor problems as expected with a new system, the overall reaction to the MHE is very favorable. Our food services personnel were very much impressed by the system and the veterinarians, as their report indicates, were equally impressed. Acceptance of the meals including T-rations prepared in the MHE appears satisfactory. We will forward additional information as applicable, received in future after-action reports. We look forward to your interim evaluation of the MHE system and the final technical report.

Sincerely

ROBERT R. REINING, JR., Colonel, USAF
DCS/Engineering and Services

1 Atch
655 Tac Hosp/SGV Ltr,
22 Apr 81

Cy to: HQ AFESC/DEH

APPENDIX H

THE DETAILS FOR A FOUR DAY WORK SAMPLING EXERCISE

Enclosed are the details for a four day work sampling exercise to be conducted in Korea over a five day period. The test will involve five data-takers working no more than two three-hour shifts per day. The methodology outlined will involve the classification of three Job Category into a two digit job activity code that will indicate both a particular task undertaking and a type ration mode employed (e.g., A-ration mode). The objective of the test will be to gather an adequate number of data, indicative of the system, to insure efficient estimation of these job activities. In this way, meaningful comparisons between the "old" and new system can be studied, as these job activities are consistent with those used in the previous study. Also intra-system ration mode comparisons can be made (A-ration vs. T-rations).

I. Specific Job Activity

Code	Description
0	Preparation - The obtaining, mixing, cutting, chopping, etc. of all ingredients used for salads, meat, and vegetable production. The general preparation of all food products.
1	Cooking - All actual activities involved in the art of cooking. For example, selecting proper temperature setting, monitoring food being cooked or reconstituted, seasoned, placing and removing food from containers, cooking food on grill or oven. Here food will include all forms of A-rations, T-rations, and short order mode.
2	Supervision - This includes review of the present system by Supervisor in procedures and methods, as well as inspection and monitering of food service areas/personnel.
3	Serving - This activity is related to activities associated with the serving line outside the purvey of "cooking". These include plating meals, setting up and breaking down serving line, replenishing the line. This also includes the time spent in position ready to serve even though there are no customers.
4	Sanitation - This encompasses all aspects of cleaning, trash disposal, and sanitation in all food service areas. For example, dishwashing, pot and pan washing, the placing of these wares into their proper receptacles, and equipment sanitation.
5	Supply - This includes the movement of supplies from the storage area as well as receiving, unpacking, etc., of these supplies from outside sources. All supply recordkeeping, inventory manipulation, internal issuance of supplies, and replenishment of all beverage equipment.

Code	Description
6	Administration - This includes cash collection and signature records, preparation of correspondence, records, and reports, publishing work schedules, cooks worksheets and other internal or external reports related to food service functions; answers telephone and relays messages; does not include supply administration.
7	Maintenance - Preventative or corrective maintenance done on any piece of equipment necessary for the completion of the food service mission. This category includes Burner Maintenance.
8	On the Job Training - This task involves knowledge either received or conveyed by an individual via oral or written instructions for the purpose of learning or reviewing techniques or skills.
9	Other Productive - Any productive task that can't be explicitly designated as any of the aforementioned.

A. Non-Productive Time

On the code sheets, non-productive times will be divided into two regions:

1) Non-Productive (System Forced) - This will occur when for reasons outside the worker's control the system is forced to be idle and the worker is unable (due to the unpracticality of the situation) to be reassigned to another area. This situation may occur in these examples: in the event of a power failure, a delay in supplies arriving to the preparation area, the depletion of tray packs to be processed with no other tasks to be performed.

2) Non-Productive (Worker) - These occurrences are spontaneous or planned respits such as lunch, coffee breaks, and head-calls where the individual induces the non-productivity.

In some instances, the type of non-productivity will be a judgemental call. However, the overriding consideration should be the "cause" for the idleness, either the system (e.g., lack of supplies) or the individual.

II. System Modes

The three modes of operation considered will be A-ration, T-ration, and short order. It will be expected that the data-taker will be able to recognize the type of mode each activity is associated with. To alleviate any confusion in recording a specific activity with its mode of operation, the simple Job Activity/Operational Mode code outlined in Table H-1 should be used and will be attached on all clipboards for easy access.

TABLE H-1

Job Activity/Operational Mode Designations

Job Activity \ Operational Mode	A-Rations	T-Rations	Short Order
Preparation (0)	00	10	20
Cooking (1)	01	11	21
Supervision (2)	02	12	22
Serving (3)	03	13	23
Sanitation (4)	04	14	24
Supply (5)	05	15	25
Administration (6)	06	16	26
Maintenance (7)	07	17	27
OJT (8)	08	18	28
Other Productive (9)	09	19	29
Non-Productive (System)	58	78	98
Non-Productive (Worker)	59	79	99

III. Job Categories

The job categories which indicates the mission of each food service personnel is detailed in Table H-2 along with the job code enlisted for the work-sheets and the expected total number of observations to be obtained for the duration of the exercise.

TABLE H-2

Job Category Information

Job Category	Code	Number of Men	Expected No. Observations
Superintendent	1	1	760
Supv/Trainer	2	1	760
Cook	3	15	10,800

IV. Worker Schedule

The schedule of workers as shown in Table H-3 is based upon the principle of balancing the sampling load among work samplers within the constraints of the four day exercise. Due to extraneous factors, however, not all personnel will sample equally as Table H-3 indicates. Each day is broken into eight 3-hour shifts with one of the five samplers assigned to each shift with no individual sampling the same shift twice. In this manner each shift will be examined three times over the five day period. Thus, the total experiment will represent 72 hours of sampling.

TABLE H-3

Work Schedule for Samplers 1-5

Shift / Day	(1) 0000 to 3000	(2) 0300 to 0600	(3) 0600 to 0900	(4) 0900 to 1200	(5) 1200 to 1500	(6) 1500 to 1800	(7) 1800 to 2100	(8) 2100 to 2400
Thursday	X	2	1	3	1	X	2	4
Friday	3	1	X	2	4	2	1	X
Monday	X	X	3	1	X	1	4	5
Tuesday	1	3	6	X	2	4	X	1
Wed	3/6							

Work Sampler Number	Total Hours of Sampling
1	24
2	21
3	12
4	12
5	3
X	

Meals	Hours
Breakfast	0530-0730
Lunch	1030-1330
Dinner	1700-2000
Night	2230-0030
Short Order	1330-1700

Job Act.	Mode	Job Cat.
Prep - 0	A-Rat - 0	Supv - 1
Cook - 1	T-Rat - 1	Trg - 2
Supv - 2	S.O. - 2	Cook - 3
Serv - 3		
Sanit - 4		
Suply - 5		
Admin - 6		
Main't - 7		
OJT - 8		
Prod - 9		

	A / T / SO
Non-Prod (S)	58 / 78 / 98
Non-Prod (W)	59 / 79 / 99

APPENDIX I

SUGGESTED WORK SCHEDULE FOR FOODSERVICE PERSONNEL IN THE FIELD

SUGGESTED WORK SCHEDULE FOR FOOD SERVICE

PERSONNEL IN THE FIELD

The following were considered in developing the suggested work schedule.

1. The superintendent and the training supervisor would not be given fixed hours so as to be available when and where needed. The training person will not spend 100% of the time in the training function. When not training, the trainer will fill in where needed.

2. Food service workers will be on duty 12 hours each day and six days per week.

3. The 0400 hour shift overlaps with the night shift for 30 minutes. (0400-0430). This is to allow for productive transition. The night crew is expected to help with breakfast preparations and these preparations can continue unabated in this manner.

4. The night shift (1630-0430) consists of two people. Demand for a night meal is expected to be light and two people are believed to be sufficient. Upon arrival at 1630 hours, they will serve supper and clean up after. The supper meal is a T-ration meal and sufficient T-rations are to be preheated to initially serve two hundred or more meals. Beverages and desserts will be self service in the dining hall. At the supper meal, it is anticipated that two people will serve at each line and two will provide backup. We believe that one person can serve the meal for short periods, thus servers can provide additional backup to replenish desserts and beverages and open additional T-ration containers, as required. After 2000 hours, the night crew prepares for breakfast and dinner as required. During the 0400-0430 overlap they would hand over preparations in progress and coordinate with the 0400 hour shift leader on work accomplished in preparation for the day meals.

5. The 0400 hour shift continues breakfast preparations and serves the breakfast. They also begin dinner preparation as required. They serve the dinner and clean up after. At least one individual continues serving the short order service until just before the supper meal is served. After the dinner is served, T-ration heating begins.

6. The 0800 hour crew performs the same functions as above. They initially clean up after breakfast and then prepare and serve the dinner, provide short order, and do T-ration heating. As the 0400 shift departs at 1600, the number on duty can be as few as three for thirty minutes (1600-1630). The short order service may be operating, but demand should be light. The T-ration heating should be well in hand. Their only duties should be checking and replenishing as necessary the beverages and desserts in the dining hall. When the 1630 night crew arrives, all preparations for the supper meal should be complete.

7. The person working the 0700-1900 hour shift, No. 15, on the suggested work schedule,is expected to be the ration pick up person and it is anticipated rations will not be picked up on Saturday and Sunday, thus this person is scheduled to be off on Sunday and cover for one of the night crew on Saturday. Hopefully, the ration run can be early in the day so that this person will be available to assist with the supper meal.

TABLE I–1
Number of People on Duty by Day and Hour

	SUN	MON	TUE	WED	THU	FRI	SAT	
0000-0100	2	2	2	2	2	2	2	
0100-0200	2	2	2	2	2	2	2	
0200-0300	2	2	2	2	2	2	2	
0300-0400	2	2	2	2	2	2	2	
0400-0430	8	9	9	10	9	9	8	
0430-0500	6	7	7	8	7	7	6	
0500-0600	6	7	7	8	7	7	6	
0600-0700	6	7	7	8	7	7	6	– Breakfast 0530-0800
0700-0800	6	8	8	9	8	8	6	
0800-0900	10	11	11	12	11	11	10	
0900-1000	10	11	11	12	11	11	10	
1000-1100	10	11	11	12	11	11	10	
1100-1200	10	11	11	12	11	11	10	– Lunch 1030-1330
1200-1300	10	11	11	12	11	11	10	
1300-1400	10	11	11	12	11	11	10	
1400-1500	10	11	11	12	11	11	10	
1500-1600	10	11	11	12	11	11	10	– Short Order 1330-1700
1600-1630	4	4	4	4	4	4	4	
1630-1700	6	6	6	6	6	6	6	
1700-1800	6	6	6	6	6	6	6	
1800-1900	6	6	6	6	6	6	6	– Dinner 1700-2000
1900-2000	6	5	5	5	5	5	6	
2000-2100	2	2	2	2	2	2	2	
2100-2200	2	2	2	2	2	2	2	
2200-2300	2	2	2	2	2	2	2	– Night Meal 2230-0030
2300-0000	2	2	2	2	2	2	2	

TABLE I–2

Suggested Work Schedule

	SUN	MON	TUE	WED	THU	FRI	SAT
1	OFF	0400-1600	0400-1600	0400-1600	0400-1600	0400-1600	0800-2000
2	0800-2000	OFF	0400-1600	0400-1600	0400-1600	0800-2000	0800-2000
3	0400-1600	0400-1600	OFF	0400-1600	0400-1600	0400-1600	0400-1600
4	0400-1600	0400-1600	0800-2000	OFF	0400-1600	0400-1600	0400-1600
5	0400-1600	0400-1600	0400-1600	0400-1600	OFF	0400-1600	0400-1600
6	0400-1600	0400-1600	0400-1600	0400-1600	0800-2000	OFF	0400-1600
7	0400-1600	0400-1600	0400-1600	0400-1600	0400-1600	0400-1600	OFF
8	OFF	0400-1600	0400-1600	0400-1600	0400-1600	0400-1600	0400-1600
9	0400-1600	OFF	0400-1600	0400-1600	0400-1600	0400-1600	0400-1600
10	0800-2000	0800-2000	OFF	0800-2000	0800-2000	0800-2000	0800-2000
11	0800-2000	0800-2000	0800-2000	0800-2000	0800-2000	0800-2000	OFF
12	0800-2000	0800-2000	0800-2000	0800-2000	1630-0430	OFF	0800-2000
13	1630-0430	1630-0430	1630-0430	1630-0430	1630-0430	1630-0430	OFF
14	1630-0430	1630-0430	1630-0430	1630-0430	OFF	1630-0430	1630-0430
15	OFF	0700 1900	0700-1900	0700-1900	0700-1900	0700-1900	1630-0430

16 Superintendent/Training
17 Supervisor

TABLE I–3

Summary by Reporting Hour Off Duty and Trainer and Superintendent Assignment

0400	6	7	7	8	7	7	6
0700	0	1	1	1	1	1	0
0800	4	3	3	3	3	3	4
1630	2	2	2	2	2	2	2
Off Duty	3	2	2	1	2	2	3
Trainer	1	1	1	1	1	1	1
Superintendent	1	1	1	1	1	1	1
Total	17	17	17	17	17	17	17

APPENDIX J

LETTER FROM THE 655TH TACTICAL HOSPITAL/SGV EVALUATING THE FOODSERVICE SYSTEM AT KIM HAE, AFB

DEPARTMENT OF THE AIR FORCE
UNITED STATES AIR FORCE HOSPITAL YOKOTA (PACAF)
APO SAN FRANCISCO 96328

655th Tactical Hospital/SGV 22 April 1981

Veterinary Activities at Kim Hae AB, Korea, During Team Spirit 81

HQ PACAF/SGV

1. Capt Richard E. Smitherman, SrA Roger Wimbush, and SrA Linda Beckett deployed with the 655th Tactical Hospital to Kim Hae AB, Korea, for Team Spirit 81. Veterinary activities during the deployment consisted primarily of food and food facility inspections.

2. Establishment inspection and medical evaluation of food facilities:

a. Food facilities at Kim Hae AB consisted of the Field Kitchen, AAFES Running Chef, and an All-Ranks Club. Daily walk-through inspections were conducted of each food facility. Weekly formal inspections with the completion of an AF Form 977 were also conducted.

b. Kim Hae Field Kitchen:

(1) The field kitchen at Kim Hae for the Team Spirit 81 was one designed by Natick Laboratories that is currently being evaluated for acceptance by the Air Force. The design is excellent. This is by far the best field kitchen I have ever seen.

(2) The general design of the field kitchen consisted of three large tents laid out lengthwise, parallel to each other, and joined by short, enclosed walkways. The longest tent, closest to tent city, was the mess tent capable of seating approximately 120 people at any one time. The middle tent was smaller and housed the serving line and all equipment needed for preparing and serving food. The third tent was for the pot and pan cleaning area, clean utensil storage, and dry storage. Outside were three large storage refrigerators, water buffaloes, fuel storage, a great trap, and a large plywood enclosed trash area.

(3) Four meals were served daily - breakfast, lunch, supper, and midnight chow. The supper menu consisted of tray pack meals or "T-rations." Eating utensils and trays were single service items.

(4) From a sanitation perspective, the design was excellent and represented a marked improvement over the field kitchens used during previous Team Spirit exercises. Important aspects of the design and equipment included the following:

(a) A real stainless steel handwashing sink with hot and cold mixed running water was available in the kitchen area. Handwashing is of course a very basic part of personal hygiene and food sanitation. This represented a very great improvement over previous years when handwashing devices had to be improvised using trashcans, immersion heaters, and number ten cans with holes punched in them.

(b) The water system was such that hot and cold running water was available throughout the kitchen. This is the first field kitchen I have seen that had hot running water. Such a system makes routine clean-up much easier.

(c) The kitchen had a real three-compartment sink set-up for washing and sanitizing pots, pans, and other utensils. Each compartment was a large stainless steel sink. The third sink had a burner located under it, so that the water temperature could be maintained above 170°F. In other field kitchens, the pot and pan sinks have been trash cans of water with immersion heaters. The Natick design is far superior. Each of the sinks drained through a grease trap located outside.

(d) The floor in the kitchen and storage area was covered with a vinyl-like material. This made cleaning with a mop very easy. In other field kitchens, the floor had been bare plywood which absorbs liquid waste and food debris making cleaning and sanitizing difficult, if not impossible.

(e) The design of the facility was such that once a person entered, he could get his food and eat without ever going back outside. In past years, one often had to go outside after being served in order to go to a dining tent. On windy days this created quite a problem with windblown food debris and trash, and also windblown contamination of food. The Natick design eliminated this problem. The Natick design is further refined in that one enters and exists through vestibules. This eliminates cold air or dust blowing into the eating area as patrons enter and exit. Trash cans are located in the exit vestibules. In this way, the trash cans are protected from being blown over.

(f) The work environment in the kitchen was very good. The past two years we had problems with inadequate light and ventilation in the Team Spirit field kitchens. However, we did not have these problems with the Natick kitchen. Lighting was excellent with overhead fluorescent lights. In addition, a white tent liner in the kitchen gave the area a lighter and more spacious feeling. Ventilation was good. The liner had ceiling panels that could be opened to allow escape of steam and excessive heat.

(g) The serving line maintained very adequate hot food temperatures. Maintaining proper hot temperatures was also helped by having two cabinet-type food warmers in the kitchen. This is the first time I have seen food warmers in the field kitchen, but it certainly makes a lot of sense.

(h) Several innovative foods were used in the kitchen.

1. Tray pack foods or "T-rations" were used for supper and as parts of other meals. These are essentially large, flat, pan-shaped cans each containing a particular food item. The trays are prepared by immersing them in boiling water. If they are heated but not used, they may be kept and used later with no danger if they have not been opened. The tray pack foods require no refrigeration. This is part of the reason why the Kim Hae kitchen this year only needed three large reefers as opposed to ten used at Cheong-ju last year.

2. Only powdered milk was used. This again significantly reduced the need for refrigeration space.

3. Dehydrated, granulated potatoes were used. The kitchen id special equipment for processing these potatoes into a variety of forms ich as french fries or scalloped potatoes.

(5) During the course of the inspection of the field kitchen, no signifiint sanitation problems that would jeopardize public health were identified. Mino· oblems were often identified. Often these were due to people just not doing the ob the way they know it should be done. This is what we often seem to encounter these field exercises. People use being in the field as an excuse for not ing the job correctly. A large part of our job, therefore, involves trying to lucate and motivate food handlers to practice proper food service sanitation. r the most part, the food handlers at the Kim Hae field kitchen did an outstandin(ob.

(6) A few changes might improve this field kitchen arrangement.

(a) I recommend that a large dial thermometer be added to the third ink compartment. When one is hand-washing dishes, 140°F water may feel as hot as 70°F. However, the water needs to be at least 170°F to adequately sanitize utensi· ie temperature of the water needs to be closely monitored with a thermometer. The nall baby dial thermometers are often scarce in the field. A large thermometer icorporated into the sink would solve this problem.

(b) There are three doors entering the back side of the tent containg the pot-and-pan room and dry storage. During this exercise the door used to between the kitchen and the refrigerators out back was the one right by the lean utensil storage. There was often a good bit of traffic with the door being eft open for extended periods of time. This allowed wind-borne dust and debris to ontaminate clean utensils. A better approach would be to use the door furthest vay from the utensil storage. This would provide better isolation of the clean tensil storage area and less chance of clean items becoming dirty.

(c) The handwashing sink arrangement would be better if a liquid soap id paper towel dispensers were attached to the sink itself. At Kim Hae, the paper owels were kept on a shelf below a table across the room. Having soap and towels ess than readily accessible may discourage some people from adequately washing ands.

(d) The hygiene of patrons could be improved if a handwashing sink or isposable hand towels are placed in the entrance vestibule.

c. AAFES Running Chef

(1) The AAFES Running Chef that operated at Kim Hae AB during Team Spirit came from Hialeah Army Garrison in Pusan. The Running Chef arrived at tent city the morning, served until evening, and then returned to Hialeah for the night.

(2) The Running Chef served such things as hot dogs, hamburgers, sandwiches id a variety of pre-packaged snack food items.

(3) A refrigerated unit and an ice chest were used for those items requirg refrigeration. A hot cabinet was used for hot foods. Food temperatures were onsistently within the proper temperature ranges.

(4) No significant sanitation problems were encountered during our inspecions of the Running Chef.

d. All-Ranks Club:

(1) The All-Ranks Club located at Kim Hae during Team Spirit 81 was operated by personnel from the Officer's Club at Hialeah Army Garrison.

(2) Food items served at the club were limited to hot dogs and hamburger. These were cooked on a charcoal grill and then kept hot with a small food warmer. Prior to cooking, the meat items were kept cold in an ice chest.

(3) No significant sanitation problems were identified at the All-Ranks Club.

3. Subsistence Inspection:

a. All the food served at the Kim Hae field kitchen, the Running Chef, and the Club came from Hialeah Army Garrison. With the exception of cucumbers, all food items were of U.S. origin. The cucumbers were Korean. These were cleaned and sanitized in a chlorine solution prior to service.

b. Veterinary food inspection at Kim Hae was fairly informal. Food was inspected for condition and wholesomeness during the daily walk-through inspection. This allowed us to inspect food both while in storage and during preparation.

c. The only food problem encountered was with cabbage. One shipment had so much rot that it was virtually unuseable. Other orders of cabbage were so bad that kitchen personnel refused to accept them. We have had similar problems with cabbage the past two years.

4. Additional Activities:

a. In addition to supervising the two enlisted veterinary personnel, Capt Smitherman also acted as supervisor of the two preventive medicine personnel assigned to the hospital. The activities of the preventive medicine section consisted primarily of monitoring water quality and inspecting latrine and shower facilities for proper sanitation. Only minor problems were identified.

b. All veterinary supplies and equipment were inventoried during the deployment. Shortages and other problems will be identified to medical supply personnel.

c. Veterinary personnel attended the in-service training sessions given by various hospital members. These sessions were very worthwhile.

d. A program of cross-training veterinary and preventive medicine personnel was begun. Veterinary personnel accompanied preventive medicine personnel for water sampling and latrine inspections. Likewise, preventive medicine personnel accompanied veterinary personnel on kitchen inspections. Ultimately, we hope to greatly expand this program so that within these two sections each person is able to do the job of each other person.

e. Veterinary personnel also actively participated in the set-up and tear-down of the hospital.

f. Capt Smitherman wrote an article on off-base public health threats that appeared in the Tent City Newsletter.

5. Summary Remarks.

a. This is probably the best Team Spirit deployment I have been on. There was much better utilization of the TAC Hospital personnel's time. The cross-training and in-service training activities were interesting and instructive. The morning marching was fun and helped develop a sense of unity and comraderie among most TAC Hospital members. These activities should be continued and expanded on future deployments.

b. Food service sanitation during the exercise was very good. Each year we seem to learn new lessons and get better. It is gratifying that we seem to be learning from past mistakes. The important place to identify past mistakes is during the planning conferences for the next exercise. In this way, the mistake can be addressed early and not repeated. For sanitation, a key person that needs to be involved in planning is the veterinarian.

c. The Natick Field Kitchen design is excellent. It eliminates many of the sanitation problems we have encountered on previous deployments. Acceptance of this design by the Air Force will greatly improve food service sanitation in the field.

Richard E. Smitherman

RICHARD E. SMITHERMAN, Capt, USAF, BSC
Chief, Veterinary Services

Atch: 19 slides and descriptions

APPENDIX K

INTERIM STATEMENT GIVEN BY ASCO DISCUSSING FAULTY SAFETY SHUTOFF VALVE

Automatic Switch Co.

Manufacturers of
DEPENDABLE CONTROL
Since 1888

ASCO

LORHAM PARK, NEW JERSEY 07932 · N.J.-(201) 666-2000 / N.Y.-(212) 344-3755

June 10, 1981

Address Orders and Replies to:
AUTOMATIC SWITCH COMPANY
BOSTON DISTRICT OFFICE
149 California Street.
Newton, Mass. 02158
Telephone (617) 527-8230

United States Army Development Labs
Kansas Street
Natick, Mass. 01760

Attention: Mr. John Perry

Reference: ASCO Shutoff Valve HV-218-982

Dear Mr. Perry:

In accordance with on-going discussions and meetings with yourself and Mr. Bumbaca, and the sample valve sent back to our plant in New Jersey, the attached engineering report has been generated. As you can see, we have determined that the O rings were incorrectly provided with ethylene propylene material rather than the viton as required. It also appears, that the diaphragm operator was damaged due to a very high pressure condition which may be a result of the mounting and installation within the system.

I would appreciate your reviewing the attached report with the intent of our meeting and discussing it further at your convenience. Additionally, we would appreciate receiving the remainder of the valves for inspection by our engineering department in New Jersey as soon as they are returned from Korea.

Thank you very much for the opportunity of being of service.

Very truly yours

AUTOMATIC SWITCH COMPANY

George A. Marrino

George A. Marrino
Sr. Field Sales Engineer

GAM:mjc
Encl.
cc: Gene Colicchio
Dominic Bumbaca, United States Army Development Labs.

Automatic Switch Co.
INTEROFFICE CORRESPONDENCE

MAIN OFFICE & PLANT, FLORHAM PARK, N.J.
Telephone: 201-966-2000

ASCO

TO: E. V. Colicchio
Valve Sales

DATE: June 1, 1981

IN REPLY REFER TO:

FROM: G. Banick
Valve Engineering

Valve HV-218-982

REF: E. V. Colicchio's memo to T. L. Johnson dated May 11, 1981

Engineering Job 52,116

Acct.
Catal
Cost
Credit
Cust Eng
Data Proc.
Division
Dtg., Sv.
Dtg., V.
Eng., Sw.
Eng., V.
Eng. P., Sw.
Eng. P., V.
Expd., Sls.
F. Superv., Sw.
F. Superv., V.
Files, Cl.
Files, Op.
Financial
Fore Gds.
Interna
Invon Cont.
Lab., Electr
Le
Le
Library
Mach. Shop
Mail
Maintn.
Mfg.
Mat. Req.
Order
Pers
Photo
Press. & Temp. Sw.
Print
Purch.
P. P. & C.
Q. Cont.
Recp
Recp. (Switch.)
Repair, V.
Sls Promo
Sls., V.
Serv., Sw
Serv., V
Spring
Special
Std., Assy.
Std., Sw.
Std., V.
Sw. Assby.
Sw. Test
Teletype
Tool
V. A
V. Test

1. In the valve returned we found that:

   A. The O-ring was ethylene propylene not Viton which is specified. Ethylene propylene will swell in gasoline and could cause leakage at the bonnet or blockage at the orifice.

   B. The diaphragm operator head had experienced a severe overpressure, something over 200 psi.

2. In analyzing the photograph and schematic which you forwarded in your memo of May 11, 1981, and also based on our lab tests of the valve returned, we have concluded that the overpressure of the diaphragm assembly was due to piping the operator downstream of the safety shut off valve. We feel that when the burner is manually shut off and the safety shut off valve closed, either manually or due to low pressure, the fuel trapped in the line between the burner flame valve and the safety shut off valve will expand due to the residual heat of the burner creating an excessive pressure causing failure of the diaphragm assembly. On a subsequent start up of the burner, fuel would then leak and cause a fire.

3. To prevent this pressure build-up the operator should be piped to the inlet side of the safety shut off valve so that any pressure build up would be taken care of by the relief valve or, we could put a lighter spring in the disc holder assembly which would allow the disc to blow off its seat and vent the gas upstream before the pressure becomes excessive.

4. We cannot satisfactorily explain the substitution of the ethylene propylene O-ring. Undoubtedly the wrong item was pulled from stock and was not noted when the valves were

- continued -

Valve HV-218-982

Engineering Job 52,116

4 - continued -

built. Our Viton O-rings are color coded with a gold dot and the ethylene propylene O-ring has one white and two yellow dots.

G. Banick

GB/ls

CC: H.H.Kaemmer
R.Watral
B.Fressola
D.Vollmer
T.L.Johnson
J.Nelson
R.D.Powell
A.Rolfe
J.A.Sisbarro
R.J.Entwisle

DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGCEN.

REFERENCE OR OFFICE SYMBOL	SUBJECT
DRDNA-UX	Pressure Test of Shut-Off Valves; File No. T-2425-81

TO: C, FSED, FEL
ATTN: D. Bumbaca

FROM: C, EA&DD, AMEL

DATE: 02 July 1981

CMT 1: ODurkin/pjg/2746

1. Reference meeting between Messrs. Bumbaca, FEL, and Barca, AMEL, on 10 June 1981 concerning pressure test of shut-off valves.

2. Background:

a. Three Automatic Switch Co. shut-off valves were identified for testing.

b. Method - Up to 250 psi was applied to gas outlet orifice to see if needle valve lifted and pressure was relieved through gas inlet orifice. Subsequently 250 psi was applied to the diaphragm to determine if pressure failure resulted.

c. Valves were tested using an hydraulic pump and a 0-250 psi gauge as shown in attached figure.

3. Results:

a. Pressure Relief Test

Sample #1 Pressure relieved at 250 psi.
Sample #2 Pressure relieved at 250 psi.
Sample #3 Pressure not relieved at 250 psi.

b. Diaphragm Test

Sample #1 No failure at 250 psi.
Sample #2 No failure at 250 psi.
Sample #3 No failure at 250 psi.

Frank Barca

1 Incl
as

FRANK BARCA, Chief
Experimental Analysis & Design Division
Aero-Mechanical Engineering Laboratory

DA FORM 2496 REPLACES DD FORM 96, WHICH IS OBSOLETE.

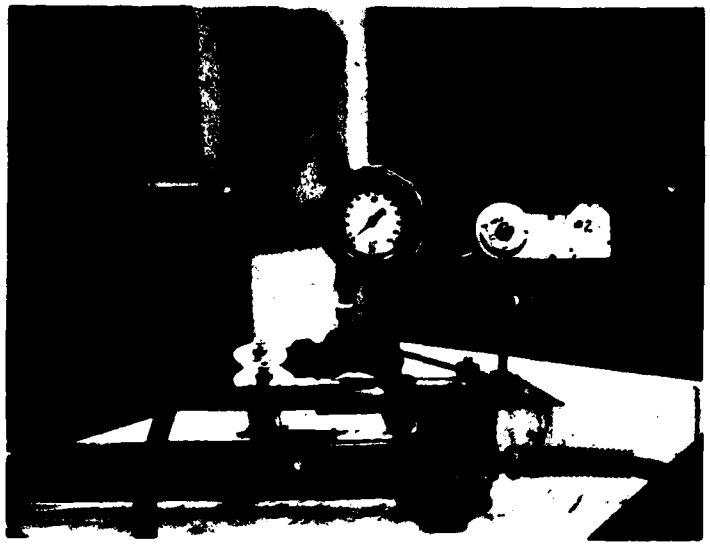


Figure K-1. Test Set-Up for Shut-Off Valves

Test Set-Up. Hydraulic pump in foreground, test valve #2 elevated on right side. Pressure gauge at center rear.

Incl 1

APPENDIX L

NEW HARVEST EAGLE (NHE) FIELD FEEDING SYSTEM MANAGEMENT GUIDELINES FOR FOODSERVICE MANAGERS

NEW HARVEST EAGLE (NHE) FIELD FEEDING SYSTEM MANAGEMENT GUIDELINES FOR FOOD SERVICE MANAGERS

The New Harvest Eagle is designed to provide high quality food service in the field with minimum manpower. In its field tests, the New Eagle functioned in accordance with its design criteria and was well received by customers and food service personnel.

To operate at maximum efficiency, the Eagle must be managed at maximum effectiveness. The management of a field feeding system presents a unique challenge to the food service manager, for it is in the field where worker interaction becomes most intense, and where time constraints produce highest pressure.

To assist the manager in managing the New Harvest Eagle, videotapes and an instructional manual have been produced. These contain procedures for system set up and operation, and an OJT program guide. Additionally, to provide general direction to the manager, several general principles of effective management are listed below. These are not intended to describe the many faceted task of system management, but to offer guidelines for the manager's most useful analysis - self-analysis:

- The successful manager is a builder of teams capable of innovation and adaptation to diverse situations.
- The successful manager recognizes and reinforces productive behavior. He does not reinforce counter productive behavior.
- The effective manager can operate and teach others to operate food service equipment.
- The mission-oriented manager assigns high priority to training <u>all</u> his people to operate <u>each</u> piece of equipment and to perform <u>each</u> major task required of a field situation.

- The development-conscientious manager is open to varied approaches to planning, implementing, and assessing food service operations.
- The productive manager includes his workers in system appraisal and development.

APPENDIX M

NEW HARVEST EAGLE FIELD FEEDING SYSTEM
ON–THE–JOB–TRAINING GUIDE

NEW HARVEST EAGLE FIELD FEEDING SYSTEM

ON-THE-JOB TRAINING GUIDE

PURPOSE

This guide provides information and guidance to be used by individuals in acquiring, while on the job, the knowledge and skills necessary to operate each major item of equipment in the Modified Harvest Eagle (MHE) Field Feeding System. It also offers an approach to certifying food service personnel as qualified field feeding experts.

BACKGROUND

The MHE is an integrated field kitchen designed to be compatible with the support requirements of an operational environment that provides only a runway and sanitary drinking water, i.e., a "Bare Base". This system has a high potential for:

- Enabling food service personnel to produce high quality meals with more menu options than previous field kitchens;
- Improving efficiency and reducing effort through the use of improved menus, equipment, and procedures.

Like all technological developments, the MHE cannot achieve the full benefits promised by new equipment and processes unless each element is installed, operated, and maintained properly. For this to happen, each member of a food service unit must be familiar with the equipment and be able to operate it safely and efficiently.

PROCEDURES

1. Examine the instruction manual and video tape to become familiar with the name and purpose of each item of equipment and assembly/operational instructions. Do this as soon as possible noting the learning objectives for each piece of equipment. These are the standards one must meet to become checked out, i.e., what you must be able to demonstrate.

2. Select one or two items of equipment as the target(s) for check out and read the appropriate sections of the manual. Identify the actual piece of equipment and inspect it carefully by observation rather than use.

3. Seek out someone who has been checked out on the equipment and ask for a demonstration and opportunity to practice under his/her supervision.

4. When prepared to demonstrate that you know or can do the things listed as learning objectives in the manual, ask to be checked out by the training supervisor. If unsuccessful, continue practice and testing until the standards are met and your check out sheet has been signed.

5. When you have been successfully checked out on an equipment item, turn in the check out sheet to the supervisor, be prepared to help others, and turn to another item of equipment. Continue until you are checked out on all items. Note that the shelter complex is different from the other items. Unless you were involved in its erection, you may be unable to actually demonstrate your knowledge. If this be the case, check out may be limited to verbal descriptions of how operations are carried out. The video tape as well as the manual will provide useful information for a successful check out.

COORDINATION AND CONTROL

Progress toward the objective of all members of the food service staff formally checked out on all items of equipment is monitored by the training supervisor. Administrative processing of records is minimized by returning all signed check out forms to the supervisor as soon as they have been completed. These forms are filed under the name of the appropriate staff member.

It should be noted that all listed learning objectives must be met for a check out signature to be justified. When a less-than-acceptable performance occurs

on check out, additional practice along with an explanation of the error may be followed by additional demonstrations of the required skill and knowledge. Thus, the requirement in every case is mastery of all the skills and knowledge described in the learning objectives.

CHECK OUT FORMS

For each item of equipment a separate form identifies the learning objectives or what must be demonstrated to be checked out on that item. At the bottom of the forms is a place for the printed name and signature of the individual certifying that all objectives have been met and the date.

One additional form is used. This is the individual record of equipment check out. It is retained as the individual's record of achievement and contains the date of check out and initials of the supervisor--entered at the time of successful check out. This individual record form is provided below. MHE OJT check out forms are provided separately.

INDIVIDUAL QUALIFICATION RECORD OF MHE EQUIPMENT

	CHECK OUT DATE	SUPERVISOR'S SIGNATURE
1. Shelter Complex Erection	_____	_____
2. Equipment Layout	_____	_____
3. Portable Water Heater and Pump	_____	_____
4. Grease Trap	_____	_____
5. Remote Tank Burner System	_____	_____
6. Shelter Lighting	_____	_____
7. Tent Heater	_____	_____
8. Steam Table and Griddle	_____	_____
9. Three Sink Assembly	_____	_____

	CHECK OUT DATE	SUPERVISOR'S SIGNATURE
10. Tray Pack		
11. Deep Fat Fryer/Ventilator/Filter		
12. Electric Potato Extruder		
13. Manual Potato Extruder		
14. Tilt Fry Pan		
15. Vegetable Slicer		

OJT TRAINING GUIDE AND CHECK OUT

NHE PROTOTYPE FIELD FEEDING SYSTEM

EQUIPMENT: SHELTER COMPLEX - ERECTION

Using the manual, available equipment, and with a previously qualified individual, learn and demonstrate that you can do all of the following. (If you did not assist in the erection of the shelter complex, describe correctly how each action listed below is carried out.)

1. Identify individual components of the shelter frame, with special attention being given to doorway purlins.

2. Work with another to assemble the shelter frame: arches, headers, and purlins.

3. Work with another to cover frame with a roof blanket which matches the type of ground purlin used.

4. Distinguish between ridge extenders and eave extenders, and install them in an appropriate place on the frame.

5. Work with another to attach fly.

6. Work with another (one person per arch) to erect shelter--first raise one side and then the other side of the shelter.

7. Secure the shelter with guylines and ground pegs.

8. Install the lighting bar between the headers. After installation of the lighting bar, the kitchen liner should be installed.

9. Work with another to install the cotton liner inside the kitchen shelter.

EQUIPMENT: SHELTER COMPLEX - ERECTION (Cont'd)

Vestibule

10. Identify individual components of the vestibule frame.

11. Work with another to assemble, cover, and erect vestibule in position as a walkway between two adjoining shelters.

When all learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: SHELTER COMPLEX - LAYOUT

Using the manual, available equipment and from a previously qualified individual, learn and demonstrate that you can do all of the following:

1. Identify the key pieces of interior and exterior food service equipment and describe their use.

2. Plan for appropriate location of key pieces of equipment and define the special requirements of these items.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: PORTABLE HOT WATER HEATER AND WATER PUMP

Using the manual, available equipment and from a previously qualified individual learn and demonstrate that you can do all of the following:

1. Select a location for the pump and water heater in close proximity to the water source and kitchen.

2. Set up the water pump for operation including the attachment of the appropriate water hoses and electrical lead.

3. Orient and set up heater for operation including the attachment of appropriate water hoses, fuel lines, and electrical lead.

4. Set up fuel drum, install fuel-vent fill assembly in the drum, and attach the return and supply fuel lines from the heater to the corresponding fitting.

5. Perform the pre-startup checks and start water pump.

6. Perform pre-startup checks and start heater.

7. If the fuel-air mixture is not correct, a combustion specialist should be consulted.

8. Adjust flow of water to sink faucets.

9. Take corrective action in event of flame safeguard control "cut-off."

10. Shut down the heater and pump and prepare for storage.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: GREASE TRAP

Using the manual, available equipment and from a previously qualified individual learn and demonstrate that you can do all of the following:

1. Choose a suitable site for location of grease trap. (A suitable site is defined in terms of distance from sinks, power source, elevation and discharge receptacle, as outlined in the manual).

2. Dig a suitable hole for grease trap.

3. Identify components of the grease trap and assemble using hammer and nails.

4. Set up sump pump, float switch, and control box.

5. Connect water hoses and electrical lead to heater.

6. Test water flow into grease trap and check that trap operates automatically.

7. Take corrective action in the event of system failure.

8. Maintain grease trap routinely to avoid excessive grease build-up.

9. Describe removal of pump and heater and preparation of equipment for storage.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: LIGHTING SYSTEM

Using the manual, available equipment, and from a previously qualified individual, learn and demonstrate that you can do all of the following:

1. Unpack lighting tubes and position them for installation.

2. Install lighting tubes in suspension straps. Adjust suspension straps so that the lighting tubes hang level.

3. Connect lighting tubes in series and to a power source and switch each ON or OFF.

4. Disconnect lighting tubes.

5. Remove lighting tubes from suspension straps.

6. Place lighting tubes in case with transformer end (heavy ends) opposite each other.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: SHELTER HEATER

Using the manual, available equipment, and from a previously qualified individual learn and demonstrate that you can do all of the following:

1. Set up the heater, including the attachment of appropriate air ducts.
2. Start up the heater and describe the operating controls.
3. Adjust temperature and volume of air flow.
4. Shut down the heater and prepare it for storage.
5. Demonstrate correct fueling procedures.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: STEAM TABLE AND GRIDDLE

Using the manual, available equipment and from a previously qualified individual learn and demonstrate that you can do all of the following:

1. Identify the individual component parts.
2. Assemble them correctly.
3. Demonstrate correct use, including filling and steam tables.
4. Demonstrate correct griddle cleaning procedures.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: THREE SINK ASSEMBLY

Using the manual, available equipment, and from a previously qualified individual learn and demonstrate that you can do all of the following:

1. Identify the individual component parts.
2. Assemble them correctly.
3. Describe procedures for the efficient use of the sinks, the drain boards, and storage racks.
4. Identify the correct water temperatures for each sink compartment.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: TRAY PACK

Using the manual, available equipment, and from a previously qualified individual learn and demonstrate that you can do all of the following:

1. Describe the different types of equipment and procedures for heating tray packed foods to serving temperatures.

2. Utilize correct procedures for heating, opening and serving tray packed products.

3. Describe correct techniques for handling a high volume of tray packs in the kitchen and in storage.

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: DEEP-FAT FRYER; FAT FILTER; PROXIMITY VENTILATOR

Using the manufacturer's operational manual* for the Deep-fat fryer, fat filter, and ventilator, as applicable, learn and demonstrate that you can do all of the following:

a. Deep-fat fryer
   1. Connect unit to electrical supply source
   2. Identify operating controls
   3. Place frying medium in cooking vessel.
   4. Turn fryer ON, set thermostat to desired temperature.
   5. Operate fryer.
   6. Turn fryer OFF.
   7. Drain fat (cautiously).
   8. Clean deep-fat fryer unit.

b. Fat Filter
   1. Connect unit to electrical supply source.
   2. Identify operating controls.
   3. Drain hot fat from deep-fat fryer into fat filter reservior.
   4. Filter oil per manufacturer's operational manual.
   5. Clean fat filter unit.

c. Ventilator
   1. Open ventilator door adjacent to fryer.
   2. Identify ventilator components.
   3. Operate ventilator.
   4. Observe filters for fat build up.
   5. Clean ventilator unit.

*See Section VIII of the "Instructional Manual".

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: POTATO EXTRUDER; AUTOMATIC ELECTRIC OPERATED & POTATO EXTRUDER; MANUALLY OPERATED

Using the manufacturers operational manual* for the electrically operated automatic potato extruder, learn and demonstrate that you can do all of the following:

a. Potato Extruder, Automatic, Electric

1. Assemble unit as per manufacturer's operational manual including the hopper extension.
2. Connect unit to supply sources, i.e., water and electrical.
3. Identify control switches and indicator lights.
4. Load hopper with potato product.
5. Place cylinder in charge position (vertical).
6. Actuate switch to charge cylinder.
7. Place charged cylinder on normal operating position.
8. Assemble cutter unit, cutter blade, baffle and front panel assembly.
9. Operate unit.
10. Shut-off unit.
11. Disassemble unit.
12. Clean unit.

b. Potato Extruder, Manually Operated

1. Identify components per manufacturers manual.
2. Load cylinder with product.
3. Place loaded cylinder on unit.
4. Extrude potato.
5. Disassemble unit and clean.

*See Section VIII of the "Instructional Manual".

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: TILT FRY PAN

Using the manufacturer's operational manual* for the tilt fry pan, as applicable, learn and demonstrate that you can do all of the following:

1. Connect unit to electrical supply source.
2. Identify controls and tilting mechanism.
3. Operate tilt fry pan per manufacturer's operational manual.
4. Clean tilt fry pan.

*See Section VIII of the "Instructional Manual".

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

EQUIPMENT: VEGETABLE SLICER

Using the manufacturer's operational manual* for the vegetable slicer, as applicable, learn and demonstrate that you can do all of the following:

1. Connect unit to electrical supply source.
2. Operate slicer per manufacturer's operational manual.
3. Disassemble unit and clean.
4. Assemble unit after cleaning.

*See Section VIII of the "Instructional Manual".

When learning objectives have been demonstrated correctly, the supervisor and worker sign here.

Worker-Name-Print _____ Signature _____

Supervisor-Name-Print _____ Signature _____

Date _____

APPENDIX N

INSTRUCTIONS FOR ELIMINATION OF CASH COLLECTIONS FROM FIELD FOOD OPERATIONS

0: 05 24/2000Z FEB 81 PP PP [illegible]

NO

FROM: HQ AFESC TYNDALL AFB FL//DEHF//

TO: HQ PACAF HICKAM AFB HI//DEHS//

HQ AFAFC DENVER CO//XSPBB//

INFO: HQ AAC ELMENDORF AFB AK//DEHS//

HQ USAFE RAMSTEIN AB GE//DEHS//

HQ TAC LANGLEY AFB VA//DEHS//

UNCLAS

SUBJECT: TEST OF ELIMINATION OF CASH COLLECTIONS FROM FIELD EXERCISES. REF HQ AFESC/DEHF LTR, 4 FEB 81.

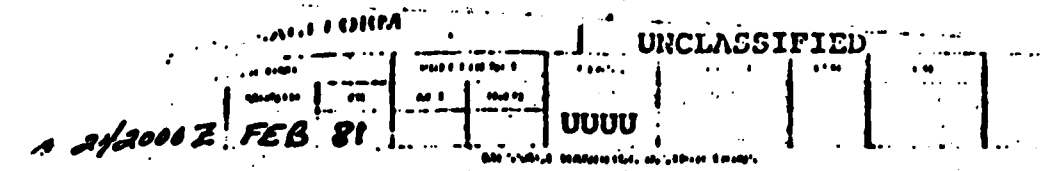
1. PARAGRAPH 4 OF SUBJECT LETTER IS HEREBY RESCINDED. THE FOLLOWING FOOD SERVICE TEST PROCEDURES ARE PROVIDED FOR USE DURING TEAM SPIRIT 81:

A. FOOD SERVICE WILL NOT MAKE CASH COLLECTIONS FOR MEALS FURNISHED TO OFFICERS, CIVILIANS OR ENLISTED MEMBERS DURING THE "ACTUAL PERIOD OF EXERCISE" FOR TEAM SPIRIT 81, REGARDLESS OF THE INDIVIDUAL'S PAY OR TRAVEL STATUS. THE EXCEPTION TO MAKING CASH COLLECTIONS WILL BE WHEN FOREIGN NATIONALS, MILITARY OR CIVILIAN, ARE AUTHORIZED USE OF THE DINING FACILITY IN ACCORDANCE WITH PARAGRAPH 1D(5) BELOW.

Mr Daugherty/DEHF/6203/

GEORGE T. MURPHY, Lt Col/DEHF/6223/

UNCLASSIFIED 24/2000ZFEB81



FROM.

TO.

B. AF FORM 113, RECORD OF MEAL CONSUMPTION, WILL BE USED IN LIEU OF CASH COLLECTIONS. HQ PACAF/ACF WILL DESIGNATE A LOCAL AFO THAT WILL BE RESPONSIBLE FOR THE CENTRAL PROCESSING OF THE AF FORMS 113 AT THE CONCLUSION OF THE EXERCISE. THE DESIGNATED AFO WILL EFFECT CREDIT TO THE P562 FUND (AT MEAL RATES SPECIFIED IN AFR 146-18) AND DEBIT THE INDIVIDUAL'S PAY RECORD OR THE PROPER APPROPRIATION.

C. AN AF FORM 113 WILL BE PROVIDED TO ALL OFFICER AND ENLISTED MEMBERS ON BAS AND CIVILIAN PERSONNEL ON PER DIEM, REGARDLESS OF THEIR BRANCH OF SERVICE. PERSONNEL WHO ARE ASSIGNED TDY TO THE EXERCISE SITE WILL COMPLETE AF FORM 113 DURING THEIR ADMINISTRATIVE IN-PROCESSING. UNEXPECTED ARRIVALS (I.E., VISITORS OR INDIVIDUALS NOT TDY TO THE EXERCISE SITE) WHO ARE AUTHORIZED USE OF THE DINING FACILITY BY THE SITE COMMANDER, WILL COMPLETE AN AF FORM 113 UPON ENTERING THE DINING FACILITY. BLANK AF FORMS 113, WITH SEQUENTIAL NUMBERS DIFFERENT FROM THOSE USED BY THE IN-PROCESSING SECTION, WILL BE MAINTAINED BY THE FOOD SERVICE OFFICER. IRRESPECTIVE OF WHERE THE AF FORMS 113 ARE PROVIDED, THEY WILL

24/2000Z FEB 81

03 05 24/2000Z FEB 81 UUUU

BE CONTROLLED IN THE FOLLOWING MANNER:

(1) THE AF FORMS 113 WILL BE PRENUMBERED IN THE EXTREME RIGHT HAND CORNER MARGIN, IN NUMERICAL SEQUENCE. THE NUMBERS ARE ENTERED IN NUMERICAL ORDER IN THE FIRST COLUMN OF AF FORM 1254, REGISTER OF CASH COLLECTION SHEETS. WHEN AN AF FORM 113 IS PROVIDED, THE RECEIVER SIGNS AF FORM 1254 OPPOSITE THE ASSIGNED NUMBER AND ENTERS THE DATE OF RECEIPT. THE INDIVIDUAL IMMEDIATELY COMPLETES THE AF FORM 113, SIGNS AND RETURNS IT IN EXCHANGE FOR A CORRESPONDENTLY NUMBERED AF FORM 577, SIGNATURE CARD, WHICH IS RETAINED THROUGHOUT THE EXERCISE PERIOD.

(2) THE IN-PROCESSING SECTION WILL BE RESPONSIBLE FOR INSURING DELIVERY OF THE COMPLETED AF FORMS 113 TO THE DINING HALL PRIOR TO OR AT THE TIME OF THE INDIVIDUAL'S FIRST MEAL.

(3) DURING MEAL PERIODS, FOOD SERVICE WILL MAINTAIN THE AF FORMS 113 ON FILE, IN NUMERICAL ORDER, AT THE HEADCOUNT STATION. AFTER MEAL PERIODS, THE AF FORMS 113 WILL BE STORED IN A SAFE OR OTHER LOCKED CONTAINER.

D. THE DINING HALL HEADCOUNTER WILL IDENTIFY ALL PATRONS PRIOR

04 05 24/2000Z FEB 81

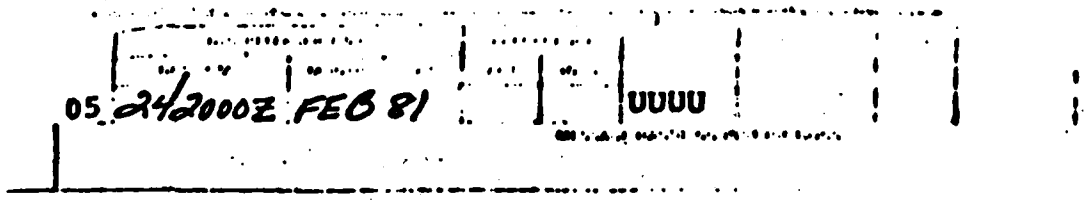
TO THEIR ENTERING THE SERVING LINE AS FOLLOWS:

(1) PERSONNEL RECEIVING BAS OR PER DIEM WILL SHOW THEIR NUMBERED AF FORM 577, SIGNATURE CARD, AND SIGN AF FORM 79, CASH COLLECTION RECORD. A CHECK MARK WILL BE ENTERED IN THE APPROPRIATE MEAL COLUMN IN LIEU OF THE DOLLAR AMOUNT. THE HEADCOUNTER WILL PROVIDE THE INDIVIDUAL WITH THE CORRESPONDENTLY NUMBERED AF FORM 113 FROM THE FILE, AND THE INDIVIDUAL WILL INITIAL THE APPROPRIATE MEAL BLOCK. THE AF FORM 113 WILL THEN BE RETURNED TO THE FILE FOR SUBSEQUENT USE.

(2) ACTIVE ENLISTED AIR FORCE MEMBERS ON SIK WILL SHOW THEIR HOME STATION DD FORMS 714 AND SIGN AF FORM 1339, DINING HALL SIGNATURE RECORD.

(3) ENLISTED AIR FORCE RESERVES AND AIR NATIONAL GUARD MEMBERS ON SIK WILL SHOW THEIR TRAVEL ORDERS AND SIGN A SEPARATE AF FORM 1339 MARKED FOR THEIR BRANCH OF SERVICE.

(4) ENLISTED MEMBERS OF OTHER MILITARY SERVICES ON SIK WILL SHOW THEIR TRAVEL ORDERS AND SIGN A SEPARATE AF FORM 1339 MARKED FOR THEIR BRANCH OF SERVICE.



FROM.

TO.

(5) FOREIGN NATIONALS (MILITARY OR CIVILIAN) AUTHORIZED TO USE THE DINING FACILITY BY THE EXERCISE COMMANDER, WILL PAY FOR MEALS IN CASH AND SIGN AF FORM 79. PAYMENT WILL BE ON THE SAME BASIS AS FOR THEIR US COUNTERPARTS, UNLESS AN AGREEMENT HAS BEEN MADE BETWEEN THE US AND THE FOREIGN GOVERNMENT FOR OTHER PROCEDURES OR CHARGES.

E. UPON CONCLUSION OF THE EXERCISE, THE FOOD SERVICE OFFICER WILL FORWARD ALL COMPLETED AF FORMS 113 TO THE SUPPORTING AFO AS DESIGNATED BY HQ PACAF/ACF. WHEN PRACTICAL, THE FORMS WILL BE HANDCARRIED TO THE SUPPORTING AFO. IF NOT PRACTICAL, THE FORMS WILL BE FORWARDED BY REGISTERED MAIL.

2. THESE ARE HQ AFESC/DEHF AND HQ AFAFC/XSPBB COORDINATED PROCEDURES.

APPENDIX O

LETTER FROM USAFESC DESCRIBING ABBREVIATED SUBSISTENCE ACCOUNTING PROCEDURES FOR TEAM SPIRIT '81

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE ENGINEERING AND SERVICES CENTER
TYNDALL AIR FORCE BASE, FLORIDA 32403

DEHF

9 JAN 1981

Abbreviated Subsistence Accounting Procedures for TEAM SPIRIT 81

HQ PACAF/DEHS

1. At Attachment 1 are abbreviated subsistence accounting procedures to be used in conjunction with the prototype field kitchen for TEAM SPIRIT 81.

2. Attachment 2 provides procedures for computing excess costs for the testing of the Tray Pack (T-Ration) Meals.

3. These accounting procedures were devised to reduce the administrative manhours currently expended in the control and accountability of subsistence during field feeding. Request your comments and recommendations on these procedures upon completion of TEAM SPIRIT 81. Action Officer at HQ AFESC is Mr. Daugherty, AUTOVON 970-6203.

FOR THE COMMANDER

Signed

GEORGE T. MURPHY, Lt Col, USAF
Chief, Food Management Division
Directorate, Housing and Services

2 Atch
1. Abbreviated Accounting Procedures
2. Excess Costs Procedures - Tray Pack

Cy to: NLABS/DRDNA-O, w/atch

EXERCISES AND FIELD FEEDING ACCOUNTING PROCEDURES

1. The normal accounting cycle for exercises and field feeding will remain the calendar month except when an exercise is of shorter duration. In a field environment, the financial status of the dining facility will be posted weekly instead of daily and a weekly physical inventory will be accomplished to determine subsistence used during the week. AF Forms 147, Field Ration Dining Hall Stock Record, and AF Forms 148, Senior Cook's Requisition, will not be used. An AF Form 249, Food Service Operations Report will not be prepared for exercises and field feeding situations. The AF Form 1119, Monthly Monetary Record, will be submitted in lieu of the AF Form 249. Further, exercises and field feeding situations will not be included in a host installation's AF Form 249. The exercise food service officer/superintendent will submit a completed AF Form 1119 directly to the appropriate MAJCOM/DEH for inclusion in the command consolidated AF Form 249.

2. The BDFA from the supporting installation plus 15 percent will be used. The 15 percent supplemental food allowance is authorized to cover the cost of additional nutritional intake due to increased physical activity under field conditions, the cost of integrating "B" ration components (or commercial equivalents) within the "A" ration menu, and the occurrence of forced substitutions of more costly food components by the supporting commissaries due to non-availability (NIS's).

3. AF Form 287, Subsistence Request, will be used to obtain subsistence from the commissary. The priced and extended copies and any vendor receipts must be retained on file as supporting documents. Reference paragraph 5-32, AFR 146-7.

4. AF Form 129, Tally In/Out will be used for turn-ins to the commissary, transfers to other dining facilities, and for subsistence medically condemned as unfit for human consumption. Reference paragraph 5-36, AFR 146-7.

5. The use of AF Form 679, Cooks Worksheet, is optional but highly recommended for use as the kitchen operating plan and to direct food preparation and use of leftovers.

6. DD Form 160, Inventory of Class ( ) Quartermaster Supplies. This form must be used to record a weekly physical inventory and the inventory which is taken at the close of business on the last day of each calendar month. For inventory procedures at the end of exercise, see para 7g(2). The inventory includes all subsistence on hand not prepared for consumption. DD Form 160 will be priced, extended and totaled. Reference paragraph 5-37, AFR 146-7.

7. AF Form 1650, Daily Dining Hall Summary, (Figure 1) will be completed on a weekly basis as follows:

a. Add the number of patrons served weekly at each meal from AF Forms 79, Cash Collection Record and AF Forms 1339, Dining Hall Signature Record and enter on line 12, Columns A through E.

b. Convert the number of meals served to weighted rations and enter on line 13.

8. AF Form 1119, Monthly Monetary Record, (Figure 2) will be completed on a weekly basis as follows:

a. Item 1 and 2. Self-explanatory.

b. Item 3. Enter the BDFA from the support base, plus a 15 percent supplemental allowance.

c. Item 4. Self-explanatory.

d. Column A (Weighted Rations). Obtain from line 13, AF Form 1650.

e. Column B (Earned Income). Multiply the entry in Column A by Item 3 (Value of the BDFA) and enter the sum.

f. Column C (Purchases). Enter the total for the week of all purchases received from the commissary and vendor delivered items (AF Form 287, Subsistence Request) and subsistence transfers from other dining facilities (AF Form 129).

g. Column D (Transfers Out). Enter the total dollar value of AF Forms 129 for subsistence transferred to other dining facilities, turn-ins to commissary, and for value of subsistence condemned by medical authorities. In all circumstances, entries on AF Form 129 will be itemized, priced, extended and totaled.

(1) At the end of the exercise, turn in the subsistence inventory to the support commissary. Enter the dollar value of the turn-in in Column D and enter a zero balance in Column K and on the Column K "TOTAL" line. In addition, enter the value of the turn-in in the "REMARKS" section.

All opened subsistence items that cannot be retained for use in troop feeding will be disposed of and quantities certified by medical authorities on AF Form 129. Enter the dollar value in Column D.

(2) The AF Forms 129 that are used as the record of turn-in of the subsistence inventory will be annotated with the words "INVENTORY TURN-IN". In this instance, recording the physical inventory on DD Form 160 will not be necessary.

h. Column E (Adjustments). No entry.

i. Column F (Issues to Kitchen). Since there is no physical opening inventory established when an exercise initially begins, the total dollar value of all subsistence purchased (Col C, AF Form 1119) during the first weekly accounting period will be the opening inventory. To determine issues to the kitchen at the end of the first week: Column C (Purchases) minus Column D (Transfers Out) minus the current Weekly Closing Inventory (Column K) equals Column F (Issues to Kitchen).

To determine issues to the kitchen for subsequent weeks: Column K (Weekly Closing Inventory) for the previous week plus Column C (Purchases) minus Column D (Transfers Out) minus the current Weekly Closing Inventory (Column K) equals Column F (Issues to Kitchen).

j. Column G (Excess Costs). Excess costs are authorized only when operational rations, In-Flight (IF) Food Packets, Meal Combat Individual (MCI), Meal Ready to Eat (MRE), etc., are used. The additional monetary allowance for the operational rations is limited to the cost of the ration/meal or packet plus 20 percent of the BDFA. The number of operational rations/meals used during the weekly accounting period will be determined by deducting the quantity on hand for the current weekly closing inventory, (DD Form 160) from the quantity on hand in the previous weekly closing inventory. The additional monetary allowance, BDFA authorization, and the excess cost are determined as follows:

(1) Additional Monetary Allowance.

(a)	100 meals used X 2.04 unit price	= $204.00
(b)	20% X 3,8051 BDFA X 100 meals used	= 76.00
	Total Allowance	$280.00

(2) BDFA Authorization (Convert meals to rations, three meals equal one ration).

33 rations X 3.8051 BDFA = $125.57

(3) Excess cost, Column G, AF Form 1119.

(a)	Total additional allowance	= $280.00
(b)	BDFA authorization	= 125.57
	Excess Cost	$154.43

k. Column H (Net Value of Issues to Kitchen). Subtract Column G from Column F and enter difference.

l. Column I. Change the title of this column to "Weekly Gains/Loss". Enter the difference between Column B, and Column H. If the difference is a loss, show it in parenthesis. This is the weekly monetary status of the dining hall.

m. Column J (Cumulative Gain/Loss). Enter the sum of Column J for the previous week and Column I for the week of entry. The entry represents a cumulative gain or loss for the month, to date. Losses are posted in parenthesis.

n. Column K. Change the title of this column to "Weekly Closing Inventory." Enter the total dollar value of DD Forms 160.

o. Item 5 (Opening Inventory). An exercise that has just commenced operation will have a zero balance for beginning inventory. If an exercise extends past one monthly accounting period, enter the dollar value of the last physical inventory accomplished the previous month.

p. Item 6 (Closing Inventory). When the exercise is to extend beyond the monthly accounting period, enter the dollar value of the last inventory annotated in Column K. This will be the opening inventory (Item 5) for the following month.

q. Item 7 (Book Inventory). No entry.

r. Item 8 (Auth Inv Adj). No entry.

s. Item 9 (Adjusted Gain/Loss). No entry.

t. Item 10 (Carryover Last Month). Enter the dollar value of Item 11, the previous month's AF Form 1119.

u. Item 11 (Cumulative Gain/Loss). This month's gain or loss (Total line Column J) and plus or minus the previous month's cumulative gain or loss in Item 10, AF Form 1119.

v. Item 12 (Date Form Completed). Self-explanatory.

w. Item 13 (Signature of Dining Hall Supervisory).

x. Item 14 (Signature of Food Service Officer).

y. Remarks Section: Report total number of operational rations used by type, unit price and total cost. Report by item, unit cost and total cost all subsistence condemned by medical authorities. Attach supporting documentations, i.e., excess cost computations and AF Form 129.

9. Control of Gain or Loss. Because of the authorization for use of the 15 percent supplemental allowance (reference paragraph 2 above) and the authority for excess cost when operational rations are used, food service managers are expected to operate within the prescribed 2 percent cumulative gain or loss tolerance.

a. If the cumulative gain or loss (Item 11, AF Form 1119) for the end of the month or exercise period exceeds 2 percent of the total earned income (total line, Column B) the food service officer will prepare a letter of explanation for indorsement by the exercise commander. The letter will be forwarded as an attachment to the AF Form 1119.

b. The MAJCOM/DEHS representative will review the explanation of circumstances that contributed to the excessive gain or loss and indicate by indorsement their concurrence or non-concurrence and forward as an attachment to the command consolidated AF Form 249.

DAILY DINING HALL SUMMARY

DINING HALL	DAY	DATE
Site #3	Monday - Sunday	1-7 Jun 80

MEALS SERVED	BREAKFAST A	LUNCH B	DINNER C	MIDNIGHT BREAKFAST D	MIDNIGHT DINNER E	TWO MEAL SCHEDULE BRUNCH F	TWO MEAL SCHEDULE SUPPER G
1. NUMBER OF MEALS SERVED FOR CASH							
2. NUMBER OF MEALS SERVED ASSIGNED AIRMEN AUTHD MEALS AT GOVT EXPENSE							
3. NUMBER OF MEALS SERVED AIR FORCE TRANSIENTS							
4. COMMON SERVICE, ARMY							
5. COMMON SERVICE, NAVY							
6. COMMON SERVICE, MARINE CORPS							
7. CROSS SERVICE *(Specify)*							
8.							
9.							
10. TOTAL MEALS	195	350	230				
11. FACTOR	X 20%	X 40%	X 40%	X 20%	X 40%	X 45%	X 55%
12. MEALS, WEIGHTED	39	140	92				

EARNED INCOME

13. NUMBER OF WEIGHTED RATIONS	271
14. BASIC DAILY FOOD ALLOWANCE *(BDFA) (Include additional allowance if authorized)*	
15. EARNED INCOME FOR TODAY *(Line 13 x Line 14)*	

MISCELLANEOUS DATA

16. NUMBER OF WEIGHTED RATIONS SERVED FOR CASH	
17. NUMBER OF PERSONNEL PRESENT FOR DUTY *(PFD)*	
18. NUMBER OF PERSONNEL ON BAS	
19. NUMBER OF PERSONNEL AUTHORIZED MEALS AT GOVERNMENT EXPENSE	

REMARKS

20. DATE POSTED TO AF FORM 1119	BY (Initials)
7 Jun 80	DAH

AF FORM MAY 79 1650

FIGURE 1

MONTHLY MONETARY RECORD

1. PERIOD & DATE OF REPORT: 1 - 30 Jun 80
2. BASE OR DINING HALL: Site 3
3. VALUE OF BDFA: 3.3088 + 15% 3.8051
4. TYPE OF RECORD: [X] UNIT [ ] CONSOLIDATED

DATE	WEIGHTED RATIONS (Line 13) AF Form 1650) A	EARNED INCOME (Line 15 AF Form 1650) B	PURCHASES (AF Forms 129 & 387) C	TRANSFERS OUT (AF Form 129) D	ADJUSTMENTS (AF Form 129) E	ISSUES TO KITCHEN (AF Form 148) F	EXCESS COSTS (AF Forms 129, 148, 387) G	NET VALUE OF ISSUE TO KITCHEN (Col F-G) H	GAIN - (Loss) DAILY (Col B-H) I	CUMULATIVE GAIN/(Loss) J	WEIGHTED MEALS SOLD K
1											
2											
3											
4											
5											
6											
7	271	1,031.18	2,555.37			1,275.89	154.73	1,121.16	(89.98)	(89.98)	1,279.48
8											
9											
10											
11											
12											
13											
14	291	1,107.28	1,084.49			1,157.45		1,157.45	(50.17)	(140.15)	1,206.52
15											
16											
17											
18											
19											
20											
21	295	1,122.50	998.74			1,039.62		1,039.62	82.88	(57.27)	1,165.64
22											
23											
24											
25											
26											
27											
28	278	1,057.82	1,245.59			1,006.95		1,006.95	50.87	(6.40)	1,404.28
29											
30	283	1,076.84	1,049.32	1,461.17		992.43		992.43	84.41	78.01	-0-
31											
TOTAL	1,418	5,395.63	6,933.51	1,461.17		5,472.34	154.73	5,317.61		78.02	-0-

5. OPENING INVENTORY	6. CLOSING INVENTORY	7. BOOK INVENTORY	8. AUTH INV ADJ	9. ADJUSTED GAIN (Loss)	10. CARRYOVER LAST MONTH	11. CUMULATIVE GAIN (Loss)
					0	78.02

REMARKS

See attached excess cost computations for operational rations. Inventory turn-in 30 Jun 80: 1461.17

12. DATE FORM COMPLETED	13. SIGNATURE OF DINING HALL SUPERVISOR	14. SIGNATURE OF FOOD SERVICE OFFICER
1 July 1980		

AF FORM APR 70 1119 PREVIOUS EDITION IS OBSOLETE. • GPO : 1971 O - 433-500 A-00000

FIGURE 2

EXCESS COST PROCEDURES FOR TEST OF TRAY PACK MEALS

Column G (Excess Costs), AF Form 1119. Excess cost for the testing of the Tray Pack Meals is authorized only when the menu in total (with exception of required supplements) is comprised of tray pack items. The additional monetary allowance is limited to the total cost of tray pack items used plus 20% of the BDFA for each patron served at the tray pack meal. The number of tray packs used will be determined by deducting the quantity of each type on hand at the current weekly closing inventory (DD Form 160) from the quantity on hand in the previous weekly inventory. To determine the total dollar value of tray packs used, multiply the number of each type by its respective unit price. The additional monetary allowance, BDFA authorization and excess cost are computed as follows:

a. Additional Monetary Allowance

(1)	48 Tray packs X respective unit price	= $386.00
(2)	20% X 3.8051 BDFA X 230 meals	= 175.03
		$561.03

b. BDFA Authorization

230 dinner meals X 40% X 3.8051 BDFA	= $350.07

c. Excess Cost, Column G, AF Form 1119.

(1)	Total Additional Allowance	= $561.03
(2)	BDFA Authorization	= 350.07
	Excess Cost	$210.96